Journal of Natural Resource and Development 13 (1) 1-4, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

ASSESSMENT OF DIFFERENT ORGANIC MANURE ON GROWTH OF GREEN GRAM [VIGNA RADIATA (L.)]

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Received : 10.11.2017 Accepted : 16.01.2018

ABSTRACT

The green gram is a third important pulse crop after pegion pea and chickpea. Green gram is an important food legume widely consumed in India. A field experiment was conducted during *Kharif* season of 2015 on the experiment field of agriculture farm of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, satna (M.P). to assess the different organic manures like vermicompost @ (5 t/ha) farm yard manure @ (10 t/ha) nadep @ (10 t/ha) on growth and yield of green gram. The experiment was design under Randomize Block Design (factorial). Total treatment was 9 all treatment wear replicated. It was observed that maximum grain yield was found in treatments (T9) vermicompost @ 5 t/ha recorded significantly higher grain yield (693 kg/ha) over FYM (T_3)@ 10t/ha. (691 kg/ha), whereas the (T_3) found significantly higher seed yield (691 kg/ha) among all the treatments and the lowest grain yield was recorded under treatment of nadep compost @ 10 t/ha.

Key words : *Green gram (Vigna radiate L.), vermicompost, nadep, fram yard, yield.*

INTRODUCTION

The word pulse is used in India to describe the seeds of leguminous crop that are usually dicotyledons. Pulses are one of the important segments of Indian agriculture after cereals and oils. These are the excellent source of high quality protein, essential amino acids, fatty acid, fibber, minerals and vitamins *(Sharma et al., 2013)*. These crops improve soil health by fixing atmospheric nitrogen and meets up to 80% of their nitrogen requirement from symbiotic nitrogen fixation and leaves behind substantial amount of residual nitrogen and organic matter for subsequent crops thus play a key role in crop rotation due to their ability to fix atmospheric nitrogen.

Nitrogen is the most important nutrient and is seems to have quickest and pronounced effect. It is an essential constituent of protein and chlorophyll, involved in photosynthesis, respiration and protein synthesis resulted in more above ground vegetative growth and development of plant.

The phosphorus is also an essential

constituent of every living cell of plant and majority of enzymes and structural component of membrane system of cell chloroplast and mitochondria. It takes active parts in metabolisms of plants. It stimulates root development and growth at the seeding stage and also stimulates flowering, fruit setting and seed formation along with special action of leguminous crops. It includes nodule formation and *Rhizobium* activity in the roots. Thus helps in fixation of atmospheric nitrogen in the root nodules.

Potassium increases vigor and disease resistance to plants and imparts winter hardiness to legume and other crops. It is essential in the formation and transfer of starches, sugars and also helps in the formation of protein and chlorophyll. Potassium counteracts the injurious effect of excess nitrogen in plants.

Indian soils are poor in organic matter and in major plant nutrients. Soil organic matter is the key to soil fertility and soil health. In the absence of organic matter, the soil is a mixture of inert material. Organic matter induces life into this inert mixture and promotes biological activities. Although the beneficial influence of organic matter on the physical, chemical and biological properties of the soil is widely known, the full appreciation of the same remains largely ignored in present agricultural practices. The regular recycling of organic wastes in the soil is the most efficient method of maintaining optimum levels of essential plant nutrients. Recycling of organic matter in the soil should become a regular feature of modern agriculture. In the traditional agriculture, followed over generations in India, the use of plant and animal wastes as a source of plant nutrient was the common practice. The importance of organic framings and have tram recognized in present era.

MATERIAL AND METHODS

The experimental site was a well leveled field at Rajaula Agriculture Farm of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalay, Chitrakoot, Satna (M.P.). The farm is situated under agro-climatic zone - Bundelkhand region of Northern Madhya Pradesh. Geographically Chitrakoot is situated between the 25^0 10'N latitude and 80^0 52' E longitude and about 190-200 meter above mean sea level. Agro-ecologically Chitrakoot is characterised by semi-arid to arid and sub-tropical climate with hot and dry summer and cool winter. The total average annual rainfall is 800 mm. May and June are the hottest months with maximum temperature of 49°C and upto 50^0C some time. January is the coldest month of the year with average minimum temperature of 6°C. Soil of the experimental site is sandy loam in texture. The topography of the agriculture farm is undulated, pH of the chitrakoot area varies between (7.5 to 7.8) soil is extremely low in organic carbon (0.1 to 0.3 %), low in available nitrogen (135.4 kg/ha) and phosphorus (19.9) shown on table no 2. Due to light texture soil water holding capacity is low. Area is susceptible to water erosion. Most of the rainfall occurs in between 15 July to 15 September. The experiment consisted of 9 treatment combinations of applications. All these 9 treatments were tested in a Randomized block design with three replications. The details of the treatments are T_1: FYM @ 10 t / ha FYM + control (0.0% RDF) , T_2: FYM @ 10 t / ha FYM + 50% RDF (10 :20:10 N:P:K k/ha) , T_3: FYM @ 10 t / ha FYM + 100% RDF (20 :40:20 N:P_2O_5 :K_2O k/ha) ,T_4: Nadep @10 / ha Nadep + control (0.0% RDF), T_5: Nadep @10 / ha Nadep +50% RDF (10 :20:10 N:P:K k/ha), T_6: Nadep @10 / ha Nadep + 100% RDF (20 :40:20 N:P_2O_5 :K_2O k/ha), T_7:vermicompost @ 5 t /ha vermicompost + control (0.0% RDF), T_8:vermicompost @ 5 t /ha

vermicompost + 50% RDF (10 :20:10 N:P:K k/ha), T_9:vermicompost @ 5 t /ha vermincompost +100% RDF (20 :40:20 N:P_2O_5 :K_2O k/ha).

Table No. 1 : Physio-chemical composition of soil the experimental field.

S. N.	Phisio-chemical Properties	Content	Class Group
(A)	Physical analysis		
1	Sand (%)	58.45	Sandy loam
2	Silt (%)	22.48	
3	Clay (%)	19.07	
(B)	Chemical Composition		
1	Organic Carbon (%)	0.06	Low
2	Electric Conductivity dsm^{-1}	0.21	Normal
3	Soil pH (1:2.5) soil water ratio)	8.02	Neutral
4	Available nitrogen (kg/ha)	135.4	Low
5	Available phosphorus (kg/ha-1)	19.9	Medium
6	Available potassium (kg/ha-1)	26.9	High
7	Sulphur DTPA(mg/kg)	3.31	-

Table No. 2 : Growth Parameter of green gram affected by organic treatments.

Treatments	Plant height (cm) 60 (DAS)	Number of Trifolige leaves 60 (DAS)	Number of primary branches 60 (DAS)	Root length (cm) 40 (DAS)	Number of root nodules per plant40 (DAS)
T_1	26.7	18.66	19.41	16.31	6.65
T_2	28.38	21.12	20.55	17.37	6.59
T_3	28.85	21.55	20.95	17.54	7.04
T_4	27.92	18.45	19.06	15.5	6.58
T_5	27.57	20.74	19.71	17.36	6.62
T_6	28.25	21.7	20.75	16.45	6.55
T_7	26.47	19.68	19.62	16.55	6.85
T_8	27.57	21.47	20.57	16.58	6.6
T_9	29.91	22.55	21.65	17.86	7.84
SE+- =	0.2391	0.0999	0.829	0.1193	0.1702
CD 5% =	1.242	N.S	N.S	0.358	0.510

RESULTS AND DISCUSSION

Among the varieties PDM-139 attained the maximum plant height was observed at the 6o DAS, highest plant height was observed T9 (29.91cm) vermicompost @ 5 t /ha + 50% RDF (10:20:10 N: P: K k/ha) and minimum T1 (26.7cm) FYM @ 10 t / ha FYM + control (0.0% RDF) above finding was supported by Gorade et al., (2014), Khan and Khalil (2014), Kumar et al.,(2014), Chandrashekhar (2012). At T9 (22.55) maximum number of trifoliate leaves in vermicompost @ 5 t /ha + 50% RDF (10:20:10 N: P: K k/ha) and minimum in T_4 (18.45) in Nadep @10 / ha + control (0.0% RDF). The above finding is broadly in accordance with Gorade *et al., (2014), Khan and Khalil (2014), Kumar et al., (2014). Chandrasekhar (2012).* The maximum T_9 (21.65) number of primary branches was observed at 60 DAS (vermicompost @ 5 t /ha +100% RDF (20 :40:20 N:P_2O_5 : K_2O k/ha) and minimum T_4 (19.06) in Nadep @10 / ha + (0.0% RDF). At 40 DAS maximum T_9 (7.84) number of root nodules per plant was observed under vermicompost @ 5 t /ha +100% RDF (20 :40:20 N:P_2O_5 :K_2O k/ha) and minimum T_6 (6.55) number of root nodules per plant was observed under Nadep @10 / ha +100 % RDF (20 :40:20 N:P_2O_5 :K_2O k/ha). Similar results were reported by Sitaram *et at.*, (2013) also reported that application of increasing levels of vermicompost from 5 to 7.5 ton ha-1 significantly enhanced the plant height dry matter accumulation, dry Weight of root nodules and yield of green gram.

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Journal of Natural Resource and Development 13 (1) 5-10, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

AWARENESS OF WORKING AND NON WORKING WOMEN REGARDING CONSUMER PROTECTION ACT 1986

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Received : 18.12.2017 Accepted : 17.02.2018

ABSTRACT

The objective of the Consumer Protection Act, 1986 to provide speedy, simple and inexpensive redressal of consumer disputes has, therefore, been accomplished by the established of three-tier system for the redressal of grievances under the Act. Hence, in the present study entitled "Awareness of Consumer Rights and Responsibilities among Working and Non Working Women of Kanpur Nagar" efforts were made to assess the awareness and adoption practices consumer rights and responsibilities of working and non working women. Descriptive research design was used and data was collected on 120 working and 120 non-working women from 1st, 3rd, 4th and 5th zone of Kanpur Nagar. Pre- structured interview schedule was administered for data collection. Data on awareness of consumer protection act 1986 was collected by using Robert B. Frary 1996 Three-point scale. Analysis of data reveals that about CPA most of the working women were aware that compensation can be claimed for the loss (rank I) and non - working women knows simple formalities to file complaint (rank I). Most of working women and non-working women know that this act protect against misleading advertisement (rank I) and poor after sale service (rank II) whereas they are least aware about deficiency of product and service. For redressal majority were aware about complaining to manufacturer (rank I) and ranked awareness about wool mark first.

Key words : *CPA, redressal, standard marks, grievances, working and non-working women.*

INTRODUCTION

Strong and effective consumer movement is the need of the hour. It should be the way of life for all the section of the society to be a being a real consumer. The CPA, 1986 has been enacted to promote and protect the rights of consumers and provide speedy and simple redressal to consumer disputes. The three- tier quasi judicial machinery is sought to be set up at the District, State and Central levels who are to observe the principles of natural justice and have been empowered to give reliefs of a specific nature and to award whatever appropriate compensation to the consumer. Regarding the implementation of the Act the redressal machinery has not been made functional in all States/Union territories. In this connection, it become necessary that other states should make sincere efforts to implement CPA by establishing district and state level redressal agencies without any further delay. The reasons for the delay in disposal of cases were the reluctant behaviour of consumer court, irresponsible behaviour of lawyers and pending of large number of cases. Though the consumers can approach the forums directly for redressal of their grievances, they can file cases either through lawyers or voluntary consumer organization. The majority of the cases were filed through lawyers in both forums. The real purposes of consumer laws is not to make the task of securing compensation easier, but to increase the feeling of responsibility of the supplier and to reduce the risk of faulty goods or services that he wants. The real aim of the consumer protection is to compel the manufacturer and producer is to sell standard products, at fair prices, with full details of weight and measures, maintain purity in food stuff and drug. The public shall have to assert its right and demand that courts function properly. The consumer shall have come to their rescue because an alert consumer is an asset to nation. The success of this legislation will depend on effective implementation of its provision by the Central and State governments in letter and sprits. In addition, it will require support of strong broad-based consumer movement in the country, involvement of women and youth and cooperation trade and industry. Consumer education is one of these rights of consumer which is provided in United Nations guidelines as well as in CPA itself. The majority of the people in these areas opined that certainly the consumer education is helpful to prevent him from any kind of exploitation.

MATERIALS AND METHODS

Descriptive research design was planned for the present study. Data was collected on 120 working and 120 non-working women from 1st, 3rd, 4th and 5th zone of Kanpur Nagar. Thirty respondents from each selected localities of different zones (Zone I –Kalyanpur, Nawabganj, Geetanagar and kakadeo, Zone III-Govind Nagar and Shastri nagar, Zone IV-Sisamau and Zone V-Generalganj) were selected for data collection. Pre- structured interview schedule was administered for data collection. Data on awareness of consumer protection act was collected by using Robert B. Frary 1996 three-point scale. Statistical analysis of data was done by applying Frequency, Percentage, mean, S.D. Score, rank, Chi square and Paired t Test.

RESULTS AND DISCUSSION

To analyze the awareness of consumer protection act 1986. It has observed on the group of 120 Working and Non-Working Women. It is found in table 1 that 36.00 per cent working women are fully aware about the process of CPA, 26.00 per cent are partially aware about it and 58.00 per cent are unaware about it. Only 38.00 per cent know about the help of advocacy, 32.00 per cent have

knowledge of it as there is a kind of law for CPA, and 50.00 per cent are unaware of it. Some of them have a good knowledge about the filing and trials of the CPA cases. And also such type of cases are not so expensive, when they know about the fact of expenses, they become surprised to know it.

Data in table 2 reveals that both working m.s. 2.12 and non working m.s.1.98 women were aware that CPA protects against misleading advertisement at Rank I whereas awareness was at rank II for poor after sale service with m.s. 2.11 for working women and m.s.1.78 for non working women. Least awareness for protection offered against CPA was observed for deficiency in product and service m.s.1.85 among working women and for violations of any other applicable laws and regulations m.s.1.35 among non working women RankVIII. It shows that working women were more aware about protection offered against CPA.

Analysis of data in table 3 reveals that regarding redressal mechanism consumer showed highest awareness about compliance to the seller/manufacturer (m.s. 2.37 for working women and m.s. 2.12 for non-working women) rank I. Working women ranked II to complaining to MRTP commission (m.s. 2.27) whereas nonworking women to giving complaint to redressal cell (m.s.1.60) and vice versa for rank III with m.s. 2.25 for working women and m.s. 1.50 for non-working women. Complaining to civil court was ranked V by working women (m.s.2.03) and IV by non-working women (m.s. 1.47), whereas,

Table 1: Distribution of respondents regarding Consumer Protection Act

S. No	Features of filling complaint	Working Woman (n=120)					Non Working Woman (n=120)				
		Fully aware	Partially aware	Not Aware	Score	Rank	Fully aware	Partially aware	Not Aware	Score	Rank
1	Simple formalities to file complaint	36 (30.00)	26 (21.67)	58 (48.33)	1.81	VI	08 (6.67)	16 (13.33)	96 (80.00)	1.27	I
2	Advocate not compulsory	38 (31.67)	32 (26.67)	50 (41.67)	1.90	V	06 (5.00)	14 (11.67)	100 (83.33)	1.22	IV
3	Consumer themselves can conduct cases	44 (36.67)	32 (26.67)	44 (36.67)	2.00	III	06 (5.00)	16 (13.33)	98 (81.67)	1.23	III
4	Complaints may be sent even through registered post	36 (30.00)	48 (40.00)	36 (30.00)	2..00	III	08 (6.67)	12 (10.00)	100 (83.50)	1.23	III
5	Registered consumer organizations or government can also file complaint on behalf of consumer(s)	38 (31.67)	28 (23.33)	66 (55.00)	1.96	IV	10 (8.33)	12 (10.00)	98 (81.67)	1.26	II
6	Less expensive	44 (36.67)	36 (30.00)	40 (33.33)	2.03	II	06 (5.00)	10 (8.33)	104 (86.67)	1.18	V
7	Compensation can be claimed for the loss suffered including mental agony	54 (45.00)	22 (18.33)	42 (35.00)	2.06	I	06 (5.00)	08 (6.67)	106 (88.33)	1.17	VI

Protection offered against Consumer Protection Act

Table 2 : Distribution of Respondents According to Protection Offered Against Consumer Protection Act

S. No.	Protection Offered Against CPA	Working Woman (n=120)					Non working Women (n=120)				
		fully aware	Partially aware	Not Aware	Score	Rank	fully aware	Partially aware	Not Aware	Score	Rank
1	Deficiency in product or service	38 (31.67)	26 (21.67)	56 (46.67)	1.85	VIII	08 (6.67)	30 (25.00)	82 (68.33)	1.38	VII
2	Poor after sale service	52 (43.33)	30 (25.00)	38 (31.67)	2.11	II	28 (23.33)	38 (31.67)	54 (45.00)	1.78	II
3	Damage /Loss to health, life and property due to product	46 (38.33)	40 (33.33)	34 (28.33)	2.01	V	24 (20.00)	34 (28.33)	62 (51.67)	1.68	III
4	Hazard arising out of product/service	36 (30.00)	28 (23.33)	56 (46.67)	1.83	IX	14 (11.67)	24 (20.00)	82 (68.33)	1.43	VI
5	Unjust enrichment through unfair mean	38 (31.67)	42 (35.00)	40 (33.33)	1.98	VI	12 (10.00)	22 (18.33)	86 (71.67)	1.38	VI
6	Misleading advertisement	54 (45.00)	26 (21.67)	40 (33.33)	2.12	I	38 (31.67)	42 (35.00)	40 (33.33)	1.98	I
7	Unfair Trade Practices	38 (31.67)	48 (40.00)	34 (28.33)	2.03	IV	24 (20.00)	32 (26.67)	64 (53.33)	1.67	IV
8	Restrictive Trade Practices (like tie-up sales)	40 (33.33)	52 (43.33)	28 (23.33)	2.10	III	10 (8.33)	36 (30.00)	74 (61.67)	1.47	V
9	Violations of any other applicable laws or regulations	36 (30.00)	44 (36.67)	40 (33.33)	1.97	VII	10 (8.33)	22 (18.33)	88 (73.33)	1.35	VII

Table 3: Distributions of Respondents According to Awareness of Redressal Mechanism

S. NO.	Redressal Machanism in CPA	Working Women (n=120)					Non Working Women (n=120)				
		fully aware	Partially aware	Not Aware	Score	Rank	fullyaware	Partially aware	Not Aware	Score	Rank
1.	Compliance to the seller/ manufacturer	68 (56.67)	28 (23.33)	24 (20.00)	2.37	I	54 (45.00)	26 (21.67)	40 (33.33)	2.12	I
2.	Giving complaint to redressal cell	58 (48.33)	34 (28.33)	28 (23.33)	2.25	III	28 (23.33)	16 (13.33)	76 (63.33)	1.60	II
3.	Filing case in consumer forum- **DISTRICT**:(less than Rs.20lacks) **STATE**:(less than 20 lacks but less than1 crore) **NATIONA**L:(More than Rs.1crore)	36 (30.00)	24 (20.00)	60 (50.00)	1.80	VI	08 (6.67)	16 (13.33)	96 (80.00)	1.27	VI
4.	Complaining to civil court	36 (30.00)	52 (43.67)	32 (26.67)	2.03	V	14 (11.67)	28 (23.33)	78 (65.00)	1.47	IV
5.	Complaining to MRTP Commission	48 (40.00)	56 (46.67)	16 (13.33)	2.27	II	12 (10.00)	26 (21.67)	92 (76.67)	1.50	III
6.	Complaining to the officers of respective Department	42 (35.00)	58 (48.33)	20 (16.67)	2.18	IV	10 (8.33)	22 (18.33)	88 (73.33)	1.35	V

Table 4 : Distribution of Respondents According to Awareness about Various Standard Marks

S. No.	Various Standard Marks	Working Women (n =120)					Non Working Women (n =120)				
		Fully aware	Partially aware	Not aware	Score	Rank	Fully aware	Partially aware	Not aware	Score	Rank
1.	ISI (Indian standard institute)	58 (48.33)	36 (30.00)	26 (21.83)	2.27	II	22 (18.33)	38 (31.67)	60 (50.00)	1.68	II
2.	AGMARK	48 (40.00)	56 (46.67)	16 (13.33)	2.27	II	14 (11.67)	32 (26.67)	74 61.67)	1.50	IV
3.	FPO (Fruit product or order)	46 (38.33)	34 (28.50)	40 (33.33)	2.05	III	16 (13.33)	32 (26.67)	72 (60.00)	1.53	III
4.	Wool mark	68 (56.67)	38 (31.50)	14 (11.67)	2.45	I	38 (31.67)	28 (23.33)	54 (45.00)	1.87	I
5.	Eco mark	38 (31.67)	46 (36.67)	36 (30.00)	2.02	IV	10 (8.33)	22 (18.33)	88 (73.33)	1.35	V

complaining to the officer of respective department was ranked IV by working women (m.s.2.18) and V by non-working women (m.s. 1.35). Both the group of respondents showed least awareness Rank VI about filling case in consumer forum m.s.1.80 working women and m.s. 1.35 non-working women. Overall mean score for awareness was observed higher among working women as compared to non-working women.

Standard marks:

From the table 4 it is revealed that both working m.s.2.45 and non working m.s. 1.87women showed highest awareness about WOOL Mark followed by ISI Mark m.s.2.27 and m.s.1.68 respectively. Working women were also showed awareness about AGMARK at Rank II m.s. 2.27. FPO was ranked III by both working and non working women for awareness with m.s. 2.05 and m.s.1.53 respectively. It is clear that working women were more aware than non working women as for as awareness for standard marks is concerned.

CONCLUSION

The study has revealed the fact that the consumers in general, lack consumer rights awareness regarding the existence of protective services provided by the government and the voluntary consumer organization for redressal of their grievances and that is the main cause that the consumer in this area are prone to exploitation in the market today. During the course of study, it was found that consumers were not completely satisfied with the functioning of the Consumer Dispute Redressal Forum (CDRF). At the same time, they also expressed their dissatisfaction with regard to the use of day to day products and the services of various kinds including the public utility departments. The study, thus, has revealed the slacunae in the existing protective services available in India particularly in these areas, which would serve as clue to the authorities to make improvements in these measures. For the redressal of their grievances with regard to both the products and services, if they approach the distric forum, more time is required for the disposal of their complaints.

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Journal of Natural Resource and Development 13 (1) 11-17, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

CHECKLIST OF DIATOMS SPECIES AVAILABLE ALONG THE VERAVAL COAST

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Received : 09.01.2018 Accepted : 15.03.2018

ABSTRACT

The present study on biological diversity of marine diatoms along coastal waters at Veraval was carried out along Saurashtra coast. Study was conducted from May 2012 to April 2013. During present study 133 spp. of Diatoms were observed. Among them Coscinodiscus asteromphais, C. subtilis, C. oculus iridis, Odontella mobiliensis, O. rhombus, Melosira molyniformis, Grammatophora marina, Thalassiothrix frauenfeldii, Rhabdonema sp., Navicula longa, Navicula sp., Nitzschia lanceolata, N. seriata, Licmophora abbreviata, Pleurosigma aestuarii and P. normanii were the dominant diatom species throughout the study.

Key words : *Checklist, diatoms, bacillariophyceae, diversity, veraval coast.*

INTRODUCTION

Phytoplanktons are found in greater abundance in coastal areas, typically within the upper 50 m of the water column. The name “phytoplankton” consists of two Greek words meaning “phyto” (plant) and “plankton” (wanderer). There are two major groups of phytoplankton — (1) fast-growing diatoms, which have no means to propel them through the water, and (2) flagellates and dinoflagellates, which can move.

Usually, most species of phytoplankton are at the mercy of oceanic currents for transport to areas that are suitable for their survival and growth (Sandifer et al., 1980; Daws, 1998). Thus, physical processes play a significant role in determining their distribution. Rapid cell division and population growth in phytoplankton produce blooms and also determine the primary productivity of the ecosystem.

Diatoms constitute the major part of

the phytoplankton of seawater. They are important because they serve as the first vital link in the food chain, either directly or indirectly, of almost every animal. Probably at least at some part of their life history, all fish, molluscs and crustaceans are diatom feeders. They are broadly divided into two major divisions: the centrales or centricae and the pennales or pennatae, depending on the structure and sculpture on their cell walls. The valves of centrals are having radiating sculpture either central or lateral, without raphe and without movement. They are radially symmetrical. The valves of pennales are neither centrally constricted nor arranged in relation to a central point, but to a median line. They are bilaterally symmetrical having boat shaped or crescent shaped or linear structure. True raphe or hyaline median line is always present on the valve. The cells can move spontaneously, if true raphe is present.

Fragments of diatoms, primarily of Coscinodiscus sp. have found as food items in the gut contents of Acetes sp. (Metillo, 2002). The micronectonic sergestid shrimps of the genus Acetes are known to be selective omnivores upon phytoplankton and zooplankton (Xiao and Greenwood, 1993; Mcleay and Alexander, 1998). Acetes acts as an important food items to many predators, such as squids, 151 species of fish (including whale shark), prawns, young crocodiles and the many people of Asia (Omori, 1974, 1975, 1977; Xiao and Greenwood, 1993). Planktons are also the good indicators of climate change (Hays, 2005).

MATERIALS AND METHODS

Study sites

The present study was conducted along the coastal waters of Veraval (21° 35' N, 69° 36' E), which is situated along the western coast of Gujarat, India. The present study was conducted from May 2012 to April 2013 i.e. for one year. For collection of sample two Locations (Location 1: Jaleshwar & Location 2: Near Sagareshwar Mandir; Figure 1) are selected. Sampling was done at fortnightly interval.

Sampling procedure and laboratory analysis

Test sieve method was used for the collection of diatom samples from the selected locations. Fifty liter of water was filtered through sieve unit from all the three sites of both the locations to collect the diatom samples separately. In the test sieve method, sieves consisting of four different mesh sizes i.e., 37 µ, 53 µ, 125 µ, 250 µ were used. Using these four types of sieves that are arranged horizontally, diatom samples were collected by filtering the seawater. The concentrate of water samples containing diatoms were collected from the last two sieves (i.e., 53 µ and 37 µ sized sieves) and they were stored separately in labeled glass bottles adjusting the volume to 50 ml., such samples were considered as stock sample (1000 dilution).

The collected samples were preserved in 1% Lugols Iodine solution within 5 min. (2-3 drops) of collection in order to avoid damage by bacterial action and autolysis (Chandy et al., 1991; Redekar and Wagh, 2000; Harnstrom et al., 2009; Manna et al., 2010; Baytut et al., 2010). The qualitative analysis of diatoms was done by using a Sedgwick-Rafter counting chamber under Stereo Zoom Microscope (Model no.: DCM 130; USB 2.0; Resolution 1.3 Mega pixels). The identification and confirmation of the taxonomic status of the diatoms was done up to possible taxonomic level (genus/species) by referencing relevant literature (Smith, 1977; Isamu, 1979; Santhanan et al., 1987).

RESULTS AND DISCUSSION

Diatoms species composition and abundant species

In present investigations total 133 species of diatoms were recorded belonged to

48 genera. Amongst the total population of diatoms, Centrales were represented by 23 genera containing 70 species and Pennales by 25 genera containing 63 species (Table 1; Figure 2). Most abundant diatom species were viz., Coscinodiscus sp., C. asteromphais, C. subtilis, C. oculus iridis, Odontella pulchella, O. mobiliensis, O. rhombus, Melosira molyniformis, Asterionella japonica, Grammatophora marina, Thalassiothrix frauenfeldii, Navicula sp., N. longa, Nitzschia lanceolata, N. seriata, Licmophora abbreviate, Pleurosigma aestuarii and P. normanii (Figure 3 and 4). At the sampling locations 1 and 2 species composition was similar. These diatoms were available throughout the study along the Veraval coast.

The dominant genera are viz., Coscinodiscus, Odontella, Navicula, Pleurosigma and Nitzschia. Similar study at Visakhapatnam Coast (Ganapati and Murthy, 1953) revealed that a large number of diatoms existing here are represented mainly by the genera Coscinodiscus, Biddulphia and Thallassiothrix. In the Cochin backwater about total 88 species of diatoms were observed (Gopinathan, 1972). In the Vellar estuary, southeast coast of India 11 diatoms species were reported amongst them Coscinodiscus centralis, Planktoniella sol, Biddulphia sinensis, Thalassiothrix frauenfeldii and Thalassiosira nitzschioides were dominant species (Perumal et al., 1999).

Along the off Lagos Coast reported that diatoms have constituted about 53 species (84.13%) from 23 genera and amongst them Coscinodiscus, Chaetoceros and Biddulphia were the more frequently occurring species (Nwankwo and Onyema, 2003). Studies on the daily variations of coastal phytoplankton assemblages in summer conditions of the North-eastern Mediterranean (Bay of Iskenderun), where they identified a total of 50 taxa belonging to Bacillariophyceae (Polat et al., 2005). A study conducted on the quality of water and phytoplankton characteristics in the Palk Bay, southeast coast of India at Kattumavadi revealed that the presence of 43 species of planktonic diatoms (Sridhar et al., 2006). In Pichavaram Mangroves, southeast coast of India reported that 73 diatoms species, while among them Coscinodiscus centralis, Pleurosigma elongatum, Thalassionema nitzschioides, Skeletonema costatum, Triceratium favus, Odentella sinensis, and Navicula longa formed the bulk of the population density (Nedumaran and Prabu, 2009).

At the Kaduviyar estuary, Nagapattinam, southeast coast of India during period of October 2005 to September 2006 revealed the presence of 58 species of diatoms and the most abundant species among them were Odontella sinensis, Thalassiothrix frauenfeldii, Skeletonema coastatum and Bacteriastrum comosum (Perumal et al., 2009). The dominant species of diatoms were Asterionellopsis glacialis, Thalassionema nitzschioides, Biddulphia longicuris and Chaetoceros lorenzianus recorded from the coastal waters of Kalpakkam, east coast of India (Achary et al., 2010). Amongst them the relative contribution of different groups has been pennate diatoms were 30.2% and centric diatoms were 56.3%. From the navigable channel of Gopalpur Port, East Coast of India, 71 species of diatoms were reported, while the major recorded species were Asterionellopsis glacialis, Thalassiothrix longissima, Chaetoceros curvisetus, Coscinodiscus gigas and Ditylum brightwellii which are available throughout the study (Baliarsingh et al., 2012).Table: 1 List of Diatoms taxa identified in present study

Centric Diatoms

Arachnoidiscus ornatus,

Odontella sp., O. aurita, O. granulata, O. mobiliensis, O. obtusa, O. pulchella, O. rhombus, O. sinensis, Bacteriastrum hyalinum, B. varians, Cheatoceros sp., C. affinis, C. brevis, C. curvisetus, C. decipiens, C. decipiens forma singularis, C. didymus var anglica, C. diversus, C. laevis, C. lorenzianus, C. pendulus, C. peruvianus, C. subsecundus, Coscinodiscus sp., C. anguste-lineatus, C. asteromphais, C. excentricus, C. nitidus, C. nudulifer, C. oculus iridis, C. subtilis, Climacodium frauenfeldianum, Ditylum sp., D. brightwellii, D. sol, Eucampia sp., Gossleriella tropica, Guinardia sp., Hemiaulus sp., Hyalodiscus stelliger, Lauderia borealis, Leptocylindrus danicus, Melosira sp., M. juergensi, M. molyniformis, M. nummuloides, Planktoniella sol, Podosira sp., Rhizosolenia alata, R. alata forma indica, R. crassispina, R. delicatula, R. hebatata var semispina, R. setigera, R. stolterforthii, Skeletonema coastatum, Stephanopyrix nipponica, S. palmeriana, Streptotheca thamensis, Thalassiosira sp., T. condensate, T. hyaline, T. subtilis, Triceratium sp. 1, Triceratium sp. 2, T. arcticum, T. favus, T. impar and T. reticulum.

Figure 1:
Map of sampling location at Saurashtra coast

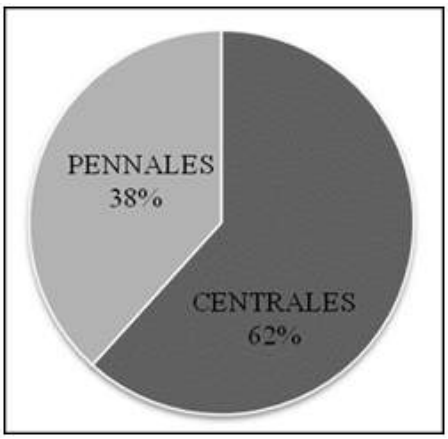

Figure 2 : Total Diatoms availability (%) along coastal waters of Veraval

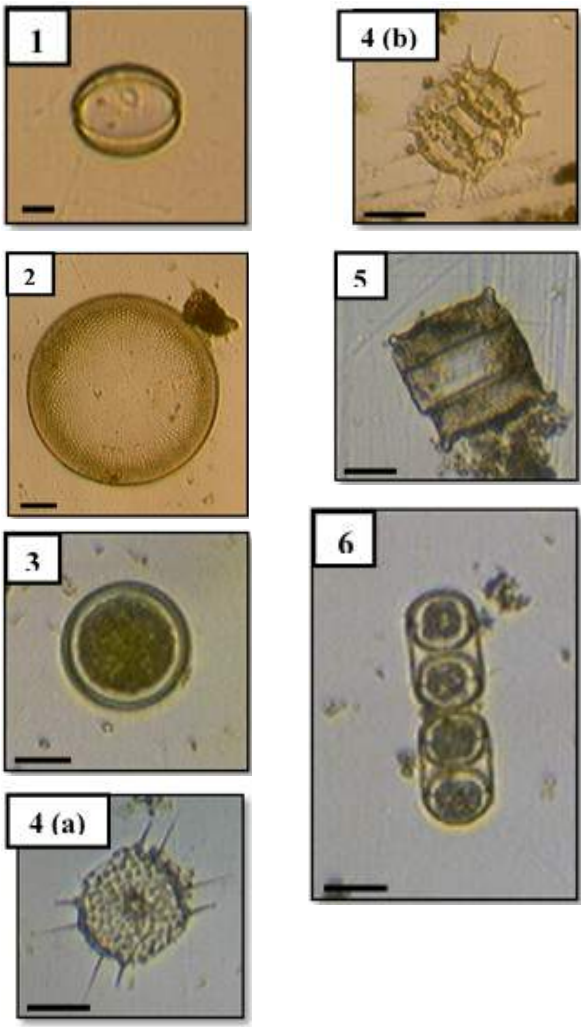

Figure 3: Major Centric diatoms observed during present study
1. *Coscinodiscus sp.*, 2. *C. asteromphais*, 3. *C. subtilis*, 4. (a,b) *Odontella mobiliensis*,5. *O. rhombus*, 6. *Melosira molyniformis* (Scale Bar = 20 µm)

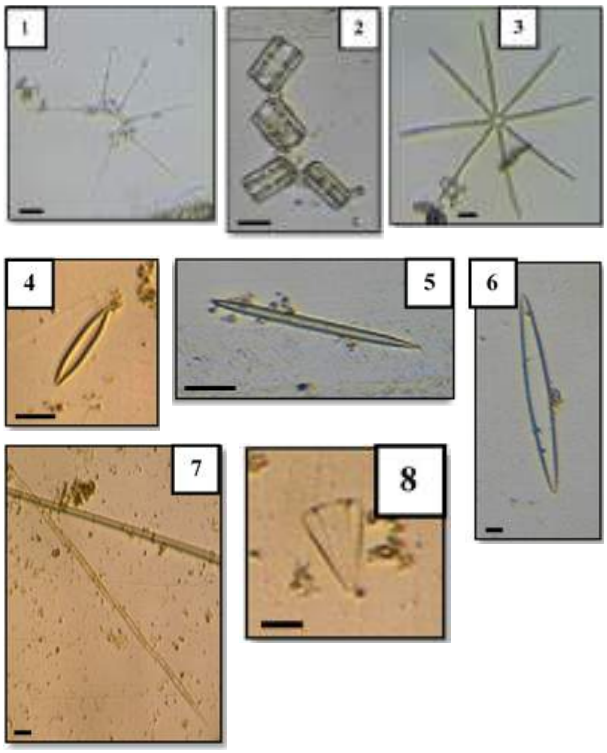

Figure 4: MajorPennals diatoms observed during present study
1. *Asterionella japonica*,
2. *Grammatophora marina*,
3. *Thalassiothrix frauenfeldii*, 4. *Navicula sp.*,
5. *N. longa*, 6. *Nitzschia lanceolata*, 7. *N. seriata*,
8. *Licmophora abbreviata* (Scale Bar = 20 µm)

Pennate Diatoms

Amphora sp., A. coastata, A. lineolata, Amphiprora sp., A. gigantiea, Achnanthes sp., Asterionella japonica, Bacillaria paradoxa, Camplyloneis sp., Campylodiscus sp., Campylosira sp., Cocconeis sp., C. placentula, Climacosphenia sp., C. moniligera, Cymbella sp., C. marina, Diploneis sp., D. Fusca, D. fusca var pelagica, D. splendica, Gyrosigma accuminatum, G. fasciola, G. spencerii, Grammatophora marina, Licmophora abbreviata, L. flabellata, Nitzschia sp., N. coasterium, N. frigida, N. lanceolata, N. longissima, N. pungens, N. seriata, N. sigma, N. sigma var intermedia, N. striata, N. vietra, Navicula sp. 1, Navicula sp. 2, Navicula sp. 3, Navicula sp. 4, N. longa, Pleurosigma sp. 1, Pleurosigma sp. 2, P. aestuarii, P. affine, P. angulatum, P. elongatum, P. galapagense, P. normanii, P. rectum, P. rigidum, Pseudonitzschia sp., Rhabdonema sp., R. adriatium, R. punctatum, Striatella unipunctata, Surirella sp., Synedra formosa, Thalassionema nitzschioides, Thalassiothrix frauenfeldii and T. longissima.

ACKNOWLEDGEMENT

We would like to thank Dr. K. L. Mathew, Professor and Head of the Department of Fisheries Resource Management, College of Fisheries, Junagadh Agricultural University, Veraval, Gujarat for his support and encouragement during this investigation. The authors are grateful to the Dr. A. Y. Desai, Dean and Principal, College of Fisheries, Veraval for having granted permission to conduct this programme. Authors are also thanks to Dr. K. L. Jetani, Scientist In charge, Marine Biological Research Station, Okha, Gujarat for providing help during species identification and sample analysis.

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Journal of Natural Resource and Development 13 (1) 18-26, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

AREA SATURATION MODEL OF FRESHWATER AQUACULTURE TECHNOLOGY DEMONSTRATION FOR LIVELIHOOD DEVELOPMENT OF TRIBAL FARMERS OF NILADRIPRASAD GRAM PANCHAYAT OF BANPUR BLOCK, KHORDHA DISTRICT, ODISHA

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Received : 10.01.2018 Accepted : 15.02.2018

ABSTRACT

An area saturation model of scientific demonstration of freshwater aquaculture technology programme was conducted in Niladriprasad Gram Panchayat (GP), a part of Banpur Block of Khordha District, Odisha for livelihood and nutritional security of the tribal farming community in that area. Twenty five ponds with total water area of 8.3 ha of 20 villages with 4725 tribal population of the GP were adopted by the ICAR-Central Institute of Freshwater Aquaculture for technology demonstration. The ponds were stocked with Indian major carps (IMC) such as, Catla catla (Catla), Labeo rohita (Rohu) and Cirrihinus mrigala (Mrigal) fingerlings (80-100 mm and 6.0-9.25 g size) at the density of 4215 nos./ha with species ration 1:1:1 in November 2015. Fishes were harvesting in May-June, 2016 after a culture period of 6.5 months. The fish production was enhanced from the baseline of 250 kg/ha/yr to a range of 428.5 - 2880 kg/ha/yr in all 20 adopted villages. From 25 ponds, a total of 6171 kg of fish were harvested during the culture period of 6.5 months and the estimated average fish production was estimated to be 1372.6 kg/ha/yr. This production was significantly higher than the base line fish production of 250 kg/ha/yr. From pond fish culture side in the dish of the farmer the fish contribution was 0.44 kg per head per year, which was raised to 1.3 kg after the scientific adoption of aquaculture technology. The present intervention of ICAR-CIFA revealed that the fish production can be increased from small seasonal homestead ponds through integrated use of seed, feed and fertilizer resources as

inputs. The study also revealed that the rural economy can be strengthened through the development of small-scale fish culture enterprises. A greater emphasis was placed on improving the knowledge and skills of the farmers for adoption of scientific farming practices, so that in future they could be in a position to continue and to expand the fish farming activities in their area.

Key words : *Aquaculture production, area saturation model, technology demonstration, livelihood development, tribal farmers.*

INTRODUCTION

Aquaculture, a system for farming aquatic plants and animals has proven its worth and utilities in providing quality proteins and nutrition security to the people. It formed a widely accepted and an effective weapon in the global fight against poverty and hunger (FAO, 2002). Pond aquaculture system is a dependable source of obtaining increased fish production in order to supply and feed for increasing population of the world (FAO, 2004). Large number of water bodies like farm ponds, tanks, community water bodies, small reservoirs, check dams, etc. are being utilized for aquaculture purposes. Many of the eastern states of India like West Bengal, Odisha and Bihar are traditionally dependent on aquaculture for protein supplements (FAO, 2014).

Odisha State is situated in the eastern part of India, occupies 4.7% of country's landmass and accounts for 3.74 % of India's population. The total population of Odisha, which was 36.8 million in 2001, increased to 41.9 million in 2011. SC and ST population constitute 17.1% and 22.8% respectively and together they constitute 39.9% of the total state population. This is comparatively higher than the all India figures of 16.6% SC and 8.6 % ST population (www.censusindia.gov.in). Census 2011 data shows that 41.8 % of the total state population constitutes workers. The percentage of main workers and marginal workers are respectively 61.0% and 18.3 % of the total workers.

Odisha poses to be a rich source of aquatic resources, such as tanks and ponds (1.25 lakh ha); reservoirs (2.0 lakh ha); lakes, swamps and bheels (1.8 lakh ha); canals and rivers (1.71 lah ha) spread across 30 districts and inland fish production was 2.94 lakh tones in 2013-14 (OFP, 2015). Odisha has 80% fish eating population and the per capita fish consumption is 9.13 kg in the state against 9.8 kg of the national average. Despite having such rich resources of aquaculture, 36,965 tonnes of fish are being imported from neighbouring state of Andhra Pradesh to meet growing demand for fishes (The Pioneer, 2017). The present study district, Khordha has total number of 6109 ponds with 2152.32 ha area (DoF, 2014).

Aquaculture development proves to be a win-win situation for both producer and consumers. These available water bodies in rural areas form the backbone of the aquaculture by providing a means for higher fish production. In present days, rural aquaculture is basically confined to rural food farming activity rather than an income generating option. Utilizing the existing water resources of the state the gap in demand and

supply of fish for domestic consumption can be bridged (www.odishafisheries.com). Systematic and scientific culture of fishes in all the available water bodies is the need of the hour. However, such holistic development is marred by technological and institutional constraints. Among which, the availability of good quality seed, capacity of farmers in aquaculture management, access to technology, access to reliable quality inputs are identified constraints. Lack of availability of quality seed of desired size and quantity make way for poor quality and unreliable seeds from outside states resulting in mortality, lesser growth and economic loss to the farmers. Therefore, transfer of the seed production technology and development of decentralized quality seed production network forms the key to the success of freshwater aquaculture in India. Keeping this in view a programme was undertaken by ICAR-CIFA during 2015-16 at Niladriprasad Gram Panchayat (GP), Banpur Block of Khordha District, Odisha to revitalize aquaculture development in an area saturation model approach. The programme was aimed at synergic development of the various aspects of aquaculture like hatchery, seed production, fish production, etc. by adopting all the ponds in the area.

MATERIALS AND METHODS

Scoping and diagnostic studies

A pre-project investigation study was carried out by an interdisciplinary team of scientists from ICAR-CIFA, Block-level officers and Gram Panchayat to assess the initial livelihood context of tribal communities and to identify the possible interventions in Niladriprasad Gram Panchayat of Banpur Block, Khordha District, Odisha, India. Consultations with tribal communities and other key stakeholders were made across the region by the study team. The meetings were followed by stakeholder workshops during Mera Gaon Mera Gaurav (MGMG) programme in the area.

Adopted zone

Niladriprasad Gram Panchayat, a part of Banpur Block (geographical coordinates: 19° 47' 0" North, 85° 11' 0" East, source Google map), Khordha District is situated 85 km away from Khordha (district headquarter) and 105 km from Bhubaneswar (capital of Odisha State). A total of 20 villages are located in this remote and forest area with limited connectivity to all the villages. The area is situated in the foot hills of the Easter Ghats Mountains. The water retention in majority of ponds and tanks is seasonal. The livelihoods of the people are primarily based on daily wages earnings, seasonal rain-fed agriculture, horticulture and allied activities such as goat farming/poultry, etc. Most of the people in these villages are unaware of scientific aquaculture activities, therefore they stock fish seeds sporadically and unsystematically as per the availability and harvest after five to six months resulting in low and unreliable fish yield.

Fig. 1. Geographical coordinates of Banpur Block, Khordha District, Odisha

ICAR-CIFA team visited the Banpur block for the first time in March 2015 to collect the primary baseline data. The team planned to implement the DBT (GoI) funded project entitled "Carp seed production in FRP hatchery and development of integrated rearing system

for livelihood development of SC/ST communities in Khordha district of Odisha" in 4 villages namely Silingpada, Aranga, Dolagobinda Nuasahi and Begunia Sahi of the GP. The initiative was converged with ICAR-CIFA programme of Tribal Sub Plan (TSP) and Mera Gaon Mera Gourav (MGMG) in 16 other villages (namely Khariapalli, Malijhola, Jiripada, Mudulidiha, Niladriprasad, Jualiamba, Raipada, Kalapata, Nilapalli, Barakoli, Krushnatara, Brahmapada, Rigidisima, Kasipada, Bighnaput and Dhuanali) of the GP totaling to 20 villages. All the ponds available in the zone (Table 2) were adopted for demonstration of composite fish culture to tribal farmers of the area. The team from ICAR-CIFA made regular visits during March 2015 to December 2016 for improvement of aquaculture productivity from all 20 villages of the GP.

Baseline-line surveys and adoption of technologies

Baseline surveys of all 20 villages from aquaculture point of view were carried out using structured questionnaire. The size of ponds adopted ranged between 0.2-1.2 ha with varying depths of 0.5-2.0 m. The water retention in ponds for aquaculture purpose was for 6-8 months. The freshwater aquaculture technologies like seed production through FRP carp hatchery and composite fish culture were adopted in the area. Normal fish culture practices were followed and the fishes were fed with 1-2% of floating pelleted feed supplied by ICAR-CIFA.

Inputs supplied

In order to overcome the constraints of quality seed production, a portable FRP carp hatchery was supplied by ICAR-CIFA under its DBT (SC/ST) funded project and installed in Aranga village during October 2016. For grow out culture, all 25 ponds were stocked with 35,000 fingerlings (@ 4215 nos/ha) and were provided with 5775 kg of floating fish feed for supplementary feeding to fishes. To maintain water quality in adopted ponds, total 1660 kg lime (@ 200 kg/ha) was supplied for application. Regular trainings and interactions with the farmers were conducted in the area for proper utilization of knowledge, inputs, etc. for enhancement of fish production from the ponds.

Physico chemical parameters

The physio-chemical properties of pond water such as temperature, transparency, pH, conductivity, total alkalinity and total hardness were analyzed as per standard laboratory procedure (APHA-AWWA-WPCF,

Table 1. The training and awareness programmes conducted for adopted zone

Sl. No.	Title	Venue	Duration	Number of participants
1	Orientation programme on Freshwater aquaculture	Aranga village, Niladriprasad G.P, Banpur	9 June, 2015	106
2	2nd National training programme on FRP carp hatchery installation and operation	ICAR-CIFA, Bhubaneswar	7-10 July 2015	2
3	Orientation programme on Freshwater Aquaculture	Niladriprasad G.P. Banpur	29 September 2015	57
4	Scientist – Farmers' Interaction Meet on "Freshwater aquaculture as livelihood option for tribal farmers"	Aranga village, Niladriprasad G.P, Banpur	24 May 2016	300
5	3rd National training programme on FRP carp hatchery installation and operation	ICAR-CIFA, Bhubaneswar	7-10 July 2016	2

1989) in an interval of every two months.

Trainings and orientation programmes conducted

ICAR-CIFA had conducted several training and awareness programmes on scientific aquaculture activities to create awareness and skills among the farmers of the area. These are enlisted in Table 1.

RESULTS AND DISCUSSION

Creation of awareness among tribal farmers

Regular awareness and orientation programmes were conducted to create interest

Table 2. Fish Harvested in the Adopted Zone

Sl. No	Name of the Village	No. of ponds	Area of ponds (in Ha)	Months of culture	Species harvested (in kg)			Total fish harvested (in kg)	Fish harvested (in kg/ha/year)
					Rohu	Catla	Mrigala		
1	Dhuanali	1	0.2	8	64	74	62	200	1500
2	Jualiamba	1	0.2	6	77	76	67	220	2199
3	*Kalapata	1	0.2	7	120	85	45	250	2142
4	Nilapalli	1	0.6	7	150	135	65	350	1000
5	Bighnaput	2	0.6	6	125	140	85	350	1166
6	Malijhola	1	0.2	7	45	30	25	100	857
7	Jiripada	1	0.3	6	80	30	40	150	1000
8	Mudulidiha	1	0.4	6	140	35	45	220	1099
9	Krusnatara	1	0.2	8	150	130	90	370	2025
10	Rigidisima	1	0.2	8	140	100	80	320	2400
11	*Kasipada	1	0.2	6	50	60	40	150	1500
12	*Raipada	3	1.2	6	170	220	140	530	1059
13	*Barkoli	1	0.6	7	30	80	40	150	428.5
14	Khariapalli	2	0.8	6	140	130	90	360	900
15	Niladriprasad	1	0.4	6	35	40	25	100	500
16	*Brahmapada	1	0.2	7	30	60	60	150	1285
17	Aranga	2	0.6	6	380	250	120	750	2500
18	Silingpada	1	0.2	5	90	110	40	240	2880
19	Dolagobinda Nuasahi	1	0.6	6	310	260	150	720	2400
20	Begunia Sahi	1	0.4	6	245	103	143	491	2455
	Total	**25**	**8.3**	**6.5 (Avg.)**	**2571**	**2148**	**1452**	**6171**	**11,392.6 (Total of 8.3 ha); 1372.60(Avg. per ha/year)**

* Data compiled by verbal enquiry

for scientific aquaculture amongst the tribal farmers of the area. In two National training programmes conducted at ICAR-CIFA during 7-10 July of 2015 and 2016, four tribal farmers were trained on FRP carp hatchery technology. ICAR-CIFA, Bhubaneswar organized a Scientist – Farmers' Interaction Meet on "Freshwater aquaculture as livelihood option for tribal farmers" at Aranga Village, Niladriprasad GP on 24 May 2016. The main objectives of the programme were to aware people on fish culture and its benefits; and also to increase fish production and productivity from their ponds; production and supply of quality fish seed in the locality; adoption of better management practices (BMPs) for enhancement of fish production in a sustainable way. The meeting was attended by the top officials of Chilika Development Authority; ICAR-CIFA; Khordha District Fisheries Office; Banpur CD Block; Banpur Tahasil and Fishery Training Institute, Balugaon. More than 300 fish farmers of Niladriprasad GP and line department officials participated in this programme.

Increased fish production achieved

After successful demonstration of scientific aquaculture technologies, farmers were able to improve aquaculture production in the adopted zone. The fingerlings (80-100 mm; 6.0-9.25 g) which were stocked in the month of November 2015 got harvested during May-June, 2016. The fish culture data is presented in Table 2. The average culture period was 6.5 months. The fish production rose from the baseline of 250 kg/ha/yr to 428.5 - 2880 kg/ha/yr. From all 25 ponds, a total of 6171 kg of fish was harvested during this period with average production estimated to be 1372.6 kg/ha/yr. The harvested size range for catla was 480-850 g; rohu 350-600 g and mrigal 250-550 g. This productivity was significantly higher than the reported base line production of 250 kg/ha/yr. The total fish productivity of ponds was found to be increased by about 2.97 times through proper feeding of the fishes.

ICAR-CIFA, Bhubaneswar had worked in several rural livelihood projects for fish production enhancement from available water resources for village communities. Some of those reports can be discussed here. The advanced fingerlings of Indian major carp (Labeo rohita, Catla catla, Cirrhinus mrigala) and minor carp (Labeo bata) were stocked in the tribal farmers (adopted) ponds of Bali Island, Sunderban Delta, West Bengal at a stocking of 10,000 nos./ha in two phases. The species ratio maintained was 3:2:2:3 for rohu: catla: mrigal: bata. Feeding was done with pelleted fish feed (EPIC) @ 2% of total body weight for initial seven months (March-September), @ 1% upto next four months (October-January) and @ 2% in the last month (February). The mean fish production achieved from 13 beneficiaries' ponds was 4483 kg/ha/year (Chakrabarti et al., 2017). Growth rate of all fishes were found comparatively high in the initial eight months (March-October). The total fish production of ponds was found to be increased by about 4.8 times through proper feeding of the fishes and maintaining ideal water quality throughout the culture period. In the present study the production from the tribal community ponds was increased 2.97 times from the base level through proper fish feeding and to some extent pond management. As the culture period was 6.5 months only, the reported increase was less than the report of Chakrabarti et al., 2017, who produced the data from perennial ponds. A women beneficiary in Odakhanda Village, Balipatana Block, Khordha district had stocked 4000 nos. of IMC fingerlings in a 2 acre size pond in September 2009 and harvested 1200 kg fish in a year (i.e., 1500 kg/ha/yr) by adopting normal

scientific aquaculture practices. This adoption was undertaken through the DST WOS-B Scheme operated by ICAR-CIFA (Anusaya et.al., 2011). Under a DBT funded project, ICAR-CIFA could demonstrate 922 kg/ha/ 6 months in ST farmers' ponds of Keonjhar district and 937 kg/ha/yr in SC farmers' ponds of Kendrapara district. With scientific interventions and support, the fish production in adopted ponds in Keonjhar district had increased in the range of 15-2800 kg/ha. The fish production was increased to the tune of 2.13 times in 2006-07 and 3.99 times in 2007-08 from the pre-adoption level (CIFA 2008-09). In another DBT sponsored scheme, ICAR-CIFA could produce 2986 kg/ha/yr (1750-4667 kg/ha/yr) in SC/ST adopted ponds in Nayagarh district and 2433.5 kg/ha/yr (1050-5075 kg/ha/yr) in Mayurbhanj district from the pre-adoptation level of 250 and 408 kg/ha/yr respectively (CIFA 2012-13). A participatory approach was envisaged by KVK (Khordha), Kausalyaganga for mobilizing communities, stocking ponds and adopted all Scientific Management Practices in Khordha District of Odisha. During 2011-13, it demonstrated fish culture in five community ponds covering an area of 6 ha. An average production of 2241 kg/ha/year was realized against the farmer's practice of 1546 kg/ha/yr (Ananth et al., 2014).

From all the reports it was found that the production of fish was below 5000 kg/ha/year. As because most of the ponds are used for community use, getting higher fish productions from those are difficult. In the present work we also could achieve higher production of 2880 kg/ha/yr fish from the area. Our results thus found to be in agreement with other authors reporting from various community/ tribal ponds in Odisha and West Bengal.

Physico chemical parameters of pond water

The range of water temperatures, pH, dissolved oxygen, total alkalinity, conductivity and transparency recorded from all ponds of the area is presented in Table 3. All the measured water quality parameters did not vary much among the adopted ponds throughout the study period and were found to be within the acceptable ranges for IMC culture.

Water quality parameter	**Value**
Temperature (°C)	28.7 – 35.2
Dissolved oxygen (mg/ l)	2.6 – 5.4
pH	6.54 – 8.2
Total alkalinity (mg/l)	50.0 – 90.0
Total hardness (mg/l)	40.0 - 60.0
Conductivity (µ mhos/cm)	186 – 232
Water transparency (cm)	6.2 – 15.5

Quality aquatic environment is the prerequisite for viable aquaculture practices. According to Mohapatra et al., 2013 the water quality required for IMC culture in pond is more than 3.0 mg/l for dissolved oxygen, 20-30 cm transparency, 100-200 mg/l total alkalinity and more than 40 mg/l total hardness. In the present study the water quality was found suitable for fish production, except muddy water in most of the ponds due to cattle bathing as evidenced with less transparency.

Livelihood development and nutritional security

The above sections clearly show that promotion of aquaculture and related livelihood interventions via. TSP, DBT (SC/ST) Project, MGMG, training, demonstration, supply of inputs and interaction with the people improved food and nutrition security among the poorest sections of tribal communities. However, it is not uncommon for livelihood interventions that are successful during the project support period to ultimately

fail after the project support is removed. This is particularly prevalent among resource-poor and marginalized people and occurs for a variety of reasons, including their inability to cope with changing social, economic and ecological contexts. In the present case the ICAR-CIFA is still providing them the technical support for adoption of scientific aquaculture practices in their ponds.

The baseline fish production from all 25 ponds of the area was 2075 kg. Hence, the fish availability from pond side in the plate of 4725 tribal persons was 0.44 kg per person per year. After adoption of scientific aquaculture practices, fish production was raised to 6171 kg. In a year of demonstration, the fish in the meal of tribal people could be raised to 1.3 kg per person per year from 0.44 kg.

Pilot projects carried out in Nuapara, Bolangir and Bargarh districts of Western Odish (WORLP, 2006; Guha et al., 2006) have demonstrated an important potential role for elements of fish production within rural livelihoods and the benefit of people-centred approaches. As the study region is bestowed with rain-fed seasonal water bodies, which have been shown to be highly effective for aquaculture practices by people, fish rearing in these water bodies is to be encouraged. Since the variable costs and revenues increase with size of pond, smaller seasonal ponds can generate a good crop of fish at a lower investment cost (Guha et al., 2006). People-centered approaches have identified that seasonal ponds are especially attractive for people who are poor, first time fish farmers or risk-averse farmers.

CONCLUSION

The institute plans to carry forward aquaculture development in the adopted zone for next one year in an area saturation model programme converging with various programmes like TSP, DBT, MGMG, etc. The training, demonstration, supply of inputs and interaction with the people will enable them to take the aquaculture in a scientific way which shall contribute significantly to the food and nutrition security of the people.

ACKNOWLEDGEMENT

The authors acknowledge the financial support from DBT (GoI) SCV/ST Project and TSP Programme operating at ICAR-CIFA for funding and the Director, ICAR - Central Institute of Freshwater Aquaculture, Bhubaneswar, India for provision of facilities for the study.

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Journal of Natural Resource and Development 13 (1) 27-31, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

EFFECT OF STONE CRUSHER DUST POLLUTION ON CHLOROPHYLL CONTENT OF LEAVES

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Received : 06.02.2018 Accepted : 16.04.2018

ABSTRACT

Stone crusher industries are the one of the major source air pollution. In the paper, comparative studies have been done, to find the effect of dust generated from the exhaust of stone crusher industries on the chlorophyll content of leaves. The study was conducted at Bharatkoop town and its surrounding region at district Chitrakoot. The leaves samples of Azadirachta indica, Butea monosperma, Dalbergia sissoo and Ficus benghelensis were collected from highly polluted and less polluted sites . A photosynthetic pigment (total chlorophyll) was quantified. A reduction in the photosynthetic pigments of plant leaves growing in higher polluted site as compared to less polluted site was found.

Key words : *Air pollution, SPM, chlorophyll content, photosynthetic pigment*

INTRODUCTION

Stone crushing Industry is an important industrial sector in the country engaged in producing crushed stone of various sizes depending upon the requirement which acts as raw material for various construction activities such as construction of roads, highways, bridges, buildings, canals etc. It is estimated that there are over 12,000 stone crusher units in India. These stone crushers though socio-economically are important sectors yet give rise to substantial quantity of fine fugitive dust emissions which create health hazards to the workers as well as surrounding population by way of causing respiratory diseases (CPCB, 2010). Atmospheric particulate matter is a mixture of diverse elements. Fine particulate matter is of great concern including dust and smoke as they are respirable, resulting in detrimental effect on human health and vegetation. Dust may affect photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants (Joshi et.al., 2009 & Farmer, 1993). The suspended particulate matter (SPM), depending on the size

and weight of particles, remain in the air for varying length of time. Those larger than 10 µm in size settle under forces of gravity on surfaces of vegetations and soil but the smaller ones remain suspended in air for longer periods of time, get dispersed and diffused by the wind, and eventually deposited on various surfaces including foliar ones (Rao, 1985). Stone dust is a primary aerosol and it is released directly from the source. It has a detrimental effect on people and environment including flora and fauna, for example, changed soil pH and productivity, formation of haze reducing visibility in the surrounding areas, destruction of habitat, damage of natural resources like valuable vegetations and wild lives, promotion of spreading of many diseases etc. (Semban and Chandrasekhar, 2000; Das and Nandi, 2002; Mishra, 2004; Sivacoumar et al., 2006).

MATERIALS AND METHODS

Five sampling sites of Bharatkoop region were selected for the study. These were Bharatkoop East (BKE), Bharatkoop West (BKW), Bharatkoop Central (BKC), Bharatkoop North (BKN), Bharatkoop South (BKS). The ambient air sampling was done for 24 hours in May, 2012.

Fine particulate sampler model APM 550, Envirotech, New Delhi and Gaseous pollutant sampler, model APM 433, Envirotech were used for particulate and gaseous sampling. Whatman glass microfiber and PTFE filters were used for PM10 and PM2.5. Toxic Indicator gaZguard, model Tx, Envirotech was used to monitor CO. All parameters were analyzed as per standard methods of National Ambient Air Quality Standard (NAAQS) prescribed by CPCB (Central Pollution Control Board). Bharatkoop village of district Chitrakoot is predominantly consisting of tropical dry and deciduous type of forest. The Plant leaves samples were collected from two different sites around Bharatkoop region viz. Site I (control site): This site includes areas 10-12 km away from the core stone crusher industrial belt. Site II (polluted site): This site includes areas within 1-2 km radius from the most major stone crusher industries. Selected plant species are of common occurrence namely, Azadirachta indica, Butea monosperma, Dalbergia sissoo and Ficus benghelensis. Total chlorophyll of leaf was estimated by Arnon (1949) method. Chlorophyll a and chlorophyll b was calculated according to the formula of Duxbury & Yentsch (1956) and Mc. Lachlan & Zalik (1963) a modification of the original equation of Arnon (1949). The entire procedure was carried out in a dark room avoiding contact with light.

(a) Chlorophyll extraction- 1 gm (fresh weight) of small pieces of leaf material was taken into a clean mortar. 10 ml of 80% acetone was added and ground the tissue to a fine pulp (grind for 2 to 3 minute). Carefully the green liquid was transferred into a test tube, covered by aluminum foil and centrifuged the liquid at 4000 rpm for about 10 minutes.

(b) Chlorophyll determination- Separated liquid is taken, read and recorded the absorbance of the chlorophyll extract with a spectrophotometer set at 663 nm & 645 nm. The amount of chlorophyll present in extract was calculated by Arnon's equations mentioned below:

Calculation

Chl a (mg gm^{-1}) = [(12.7 × A663) - (2.6 × A645)] × V (ml acetone)/W (mg leaf tissue) ---- (i)

Chl b (mg gm^{-1}) = [(22.9 × A645) - (4.68 × A663)] ×V (ml acetone) /W (mg leaf tissue) ---- (ii)

Total Chl = Chl a + Chl b ---- (iii)

where V= adjusted volume of chlorophyll extract, W= Fresh wt of leaf sample, A663= absorbance in nm at 663 nm wavelength, A645= absorbance in nm at 645 nm wavelength

Table - 1 : National Ambient Air Quality Standard, CPCD, 2009

Pollutants	**Time Weighted Average**	**Concentration in Ambient Air**		**Methods of Measurement**
		Industrial, Residentia, Rural and other Areas	**Ecologically Sensitive Area (Notified by Central Government)**	
Sulphur Dioxide (SO_2), µg/m^3	Annual 24 Hours	50 80	20 80	Improved West and Gaeke Method
Nitrogen Dioxide (NO_2), µg/m^3	Annual 24 Hours	40 80	30 80	Jacob and Hochheiser modified (NaOH and $NaAsO_2$) Method
Particulate Matter (Size less than 10 µm) or PM_{10}, µg/m^3	Annual 24 Hours	60 100	60 100	Gravimetric
Particulate Matter (Size less than 2.5 µm) or $PM_{2.5}$, µg/m^3	Annual 24 Hours	40 60	40 60	Gravimetric
Carbon Monoxide (CO), mg/m^3	8 Hours 1 Hours	02 04	02 04	NDIR

Table - 2 : Measurement of Air Pollutants during May, 2012

S. No.	**Sampling sites**	**PM_{10} (µg/m^3)**	**$PM_{2.5}$ (µg/m^3)**	**SO_x (µg/m^3)**	**NO_x (µg/m^3)**	**CO (mg/m^3)**
1	BKE	676.42	376.03	10.17	17.21	ND
2	BKW	552.32	345.86	13.34	19.04	ND
3	BKC	881.03	467.07	11.21	30.43	2
4	BKN	565.89	287.04	13.07	26.8	ND
5	BKS	415.97	188.55	9.01	21.12	ND

(ND- Non detectable)

Table-3 :Concentration of Total Chlorophyll (mg g^{-1}) in The Leaves of Collected from Polluted and Control Sites

S.No.	Plant species	Control sites (mg g-1)	Polluted site (mg g-1)
1	*Azadirachta indica*	0.838	0.495
2	*Butea monosperma*	1.230	0.682
3	*Dalbergia sissoo*	0.634	0.487
4	Ficus benghelensis	1.385	0.887

RESULTS AND DISCUSSION

Variations in physiological characteristics of selected plant species exposed to stone crusher industrial pollutants are given in Table 1. The results obtained with polluted and non polluted Azadirachta indica, Butea monosperma, Dalbergia sissoo and Ficus benghelensis were compared. In general, plants showed a decrease in photosynthetic pigments due to air pollution. Azadirachta indica, Butea monosperma, Dalbergia sissoo and Ficus benghelensis showed a significant reduction in total chlorophyll content (chlorophyll 'a' and chlorophyll 'b') in the study period.

The maximum and minimum concentration of respirable particulate matter (PM10) were 881.03 µg/m3 in Bharatkoop Central (BKC) and 415.97 µg/m3 in Bharatkoop South (BKS) (Table 2). The maximum and minimum concentration of respirable particulate matter (PM2.5) were 467.07 µg/m3 in Bharatkoop Central (BKC) and 188.55µg/m3 in Bharatkoop South (BKS) (Table 2).

The average values of SO_2 recorded were recorded in the range of 9.01 to 13.34 µg/m3 and the average values of NO_2 were in the range of 17.21- 30.43 µg/m^3 during May 2012. The concentrations of SO_2 and NO_2 were below than the permissible limits in all locations.

The concentration of total chlorophyll in the leaves of Azadirachta indica at polluted sites was recorded as 0.495 mg/g which was 0.838 mg/g at the control site (Table 3). Thus a reduction of 40.9 % in total chlorophyll was recorded in the samples from the polluted sites in comparison to control site. The concentration of total chlorophyll in the leaves of Butea monosperma at polluted sites was recorded as 0.682 mg/g which was 1.230 mg/g at the control site (Table 3). Thus a reduction of 44.59 % in total chlorophyll was recorded in the samples from the polluted sites in comparison to control site. The concentration of total chlorophyll in the leaves of Dalbergia sissoo at polluted sites was recorded as 0.487 mg/g which was 0.634 mg/g at the control site. Thus a reduction of 23.17 % in total chlorophyll was recorded in the samples from the polluted sites in comparison to control site. The concentration of total chlorophyll in the leaves of Ficus benghelensis at polluted sites was recorded as o.887 mg/g which was 1.385 mg/g at the control site (Table 3). Thus a reduction of 35.95 % in total chlorophyll was recorded in the samples from the polluted sites in comparison to control site.

CONCLUSION

This paper indicated a decline chlorophyll content in trees growing near stone crusher industries. The reduction in chlorophyll content due to degradation of

chlorophyll into phaeophytin by the loss of magnesium ions. Content of chlorophyll varies in different seasons under different conditions of pollution stress and different meteorological conditions. It can be concluded that growth of plants was found to be affected by stone crusher dust pollution. This is due to the presence of large amount of stone crusher particulate dust pollution. The chlorophyll content of Butea monosperma was found to be highly affected than Azadirachta indica, Dalbergia sissoo and Ficus benghelensis. This shows that the dust pollution caused by stone crusher industries are operative ecological factor causing deterioration in the quality of our environment. So development of green belt around the stone crusher industries is very necessary because planted trees around industries absorb pollutants in air including particulate matter so as to reduce air pollution. Trees possess some stress–tolerant mechanisms within them.

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Journal of Natural Resource and Development 13 (1) 32-38, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

EFFECT OF FEEDING INTERVAL ON MILK YIELD IN CROSSBRED COWS DURING DIFFERENT SEASONS

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Received : 10.01.2018 Accepted : 15.03.2018

ABSTRACT

The objective of the study was to determine the effect of feeding interval on milk yield in crossbred cows during different seasons. Fifteen cross bred lactating cows were divided into three groups in randomize block design (RBD). Feeding treatments consisting of three different feeding intervals of TMR in three different seasons. Feeding time of cows for once a day (T1) was at 6:00 a.m., for twice a day (T2) at 6:00 a.m. and 6:00 p.m. and for thrice a day (T3) at 6:00 a.m., 12:00 p.m. and 6:00 p.m., with 24, 12 and 6 hours interval, respectively. Cows were hand milked twice a day in morning at 4:00 AM and in evening at 4:00 PM. Test ration was given on component–fed basis. Concentrate was given according to milk production of cows ie. 1 Kg. Concentrate mixture for every 3 Kg. Milk produced. The experimental diets were offered to the cows in 40:60 concentrate and roughage ratio. This study shows that feeding interval have not very good effect on milk lactose and milk acidity in cross bred cows in all three seasons (winter, summer and rainy). But feeding interval has positive effect on milk fat, milk SNF, milk protein and milk yield in cross bred cows in all season like winter, summer and rainy.

Key words : *Total mixed ration, randomize block design, solids not fat.*

INTRODUCTION

Feeding management is critically importance in promoting good production and animal health. Feeding management is also a crucial component of animal welfare and should, therefore, be a monitoring priority for producers. In the most tropical regions including India, the majorities of bovine feeds was poor quality and composes of crop residues and agro-industrial by-products (Walli, 2010). Most of the poor smallholder farmers are unable to afford good quality feeds due to their high cost, leading to sub-optimal productivity of the animals. The hostile hot and

hot-humid climate in this region has a large human and livestock population, exerting pressure on land, which coupled with degraded pasture lands result in shortage of feeds and forages. In addition, available feed resources are not efficiently utilized due to ignorance about feeding of balanced rations by smallholder farmers. In India and other tropical countries, most of the farmers do not follow any feeding standard as they cannot scientifically compute a balanced ration for their animals. Apart from being resource poor farmer, their awareness level about the feeding of the animal is also quite low. The conventional feeding systems in India for bovine consist of feeding roughage and concentrate separately at different time intervals. Selective consumption of feeds is more in this type of feeding system which leads to lot of feed wastage and improper nutrient utilization. Milk composition is economically important to milk producers and processors and nutritionally important to consumers. Few field observations suggest that housing and management can play as large of a role as nutrition in the performance of dairy cows. For example, Bach et al. (2008) found in a cross-sectional study of 47 herds, fed the exact same ration, that 56% of the variation in observed milk production between herds was explained by non-dietary factors (e.g. presence or absence of feed refusals, free stall stocking density, and whether feed was pushed up in the feed bunk). Hot and humid environmental conditions tend to reduce milk yield in lactating dairy cows (West,2003; West et al.,2003).According to Gottardo et al. (2005), cows receiving feed in two daily distributions during the summer season increased milk yield (+15.0%) compared with animals fed once a day. In lactating cows fed once or four times a day (Nocek and Braund, 1985), feeding frequency had no significant influence on DMI or milk yield. Gibson (1984) concluded that increasing the feeding frequency of dairy cows to 4 or more times a day, compared with once or twice a day, increased the milk fat percentage by an average of 7.3% and increased milk production by 2.7%.

MATERIALS AND METHODS

Selection and distribution of animals: Fifteen cross bred cows will be selected for the study and distributed randomly based on their milk yield, parity and stage of lactation into 3 treatments groups of 5 cows in each treatment group.

Feeding and housing management of experimental animals: Feeding treatments consisting of three different feeding intervals of TMR in three different seasons. Feeding time of cows for once a day (T_1) was at 6:00 a.m., for twice a day (T_2) at 6:00 a.m. and 6:00 p.m. and for thrice a day (T_3) at 6:00 a.m., 12:00 p.m. and 6:00 p.m., with 24, 12 and 6 hours interval, respectively. The study was conducted in the winter (December- 2015), summer (March-2016) and rainy (July-2016) seasons. Experimental period was of 31 days including10 days for adaption and 21 days for measurements in each season. Data recording was done after the adaptation period. Test ration was given on component – fed basis. Wheat straw was given ad. lib. Concentrate was given according to milk production of cows ie. 1 Kg. Concentrate mixture for every 3 Kg. Milk produced. The experimental diets were offered to the cows in 40:60 concentrate and roughage ratio. Concentrate and roughage fed as total mixed ration (TMR) prepared through Keenan Mechfiber machine. Cows were hand milked twice a day in morning at 4:00 AM and in evening at 4:00 PM. All experimental cows were housed in well-ventilated cement floored shed and Feeding of the animals individually. Hygienic practices were adopted throughout the experimental period.

Preparation of total mixed ration: Total mixed ration prepared in the Keenan Mechfiber machine having digital weighing balance. Weighted quantity of wheat straw and un-chopped green maize or Barseem fodder were first added to the Keenan Mechfiber machine and processed to a proper particle length in 50 minute at 4 revolutions per minute thereafter weighted quantity of concentrate was added to the processing chamber and mixed with roughage for 5 minute at 4 revolutions per minute. TMR was taken out from the machine and offered to the cow for feeding.

Table.1 : Composition of ration (per 100 kg of DM)

Sl. No.	Particular	Parts	Seasons
1	Wheat straw	20	Winter
	Barseem	40	
	Concentrate	40	
2	Wheat straw	20	Rainy and Summer
	Green Maize	40	
	Concentrate	40	

Table. 2 : Physical composition of the concentrate mixture used (% on DM basis) for experimental diets

Sl. No.	Ingredients	Parts in concentrate mixture
1	Wheat Bran	21
2	Rice Polish	10
3	Maize Grain	32
4	Groundnut Cake	21
5	Mustard Cake	13
6	Salt	1
7	Mineral Mixture	2
Total		**100**

Milk yield and composition: Daily milk yield of per cow per day was measured the time of milking morning and evening by digital weighing balance and milk composition of each animal was determined on every day. The samples from morning and evening milking were pooled 200 ml. for each cow and were subjected to fat, S.N.F., protein, lactose, and acidity percents as per AOAC (2000).

Proximate analysis of different feed materials: Ground samples of roughage, concentrate were analyzed for proximate principles as per standard procedures (AOAC, 2000).

Statistical Analysis: The data on various parameters will be collected, tabulated and subjected to analysis of variance technique (ANOVA) as per randomized block design (RBD) of Snedecar and Cochran (1994) to determine influence of different feeding interval of feeds on parameters.

RESULTS AND DISCUSSION

Fifteen cross bred cows were selected for the study and distributed randomly based on their milk yield, parity and stage of lactation into 3 treatments groups of 5 cows in each treatment group. All experimental cows were housed in well-ventilated cement floored shed and Feeding of the animals individually. Feeding treatments consisting of three different feeding intervals of TMR in three different seasons. Feeding time of cows for once a day (T1) was at 6:00 a.m., for twice a day (T2) at 6:00 a.m. and 6:00 p.m. and for thrice a day (T3) at 6:00 a.m., 12:00 p.m. and 6:00 p.m., with 24, 12 and 6 hours interval, respectively. The study was conducted in the winter (December- 2015), summer (March-2016) and rainy (July-2016) seasons. Experimental period was of 31 days including10 days for adaption and 21 days for measurements in each season. Data recording was done after the adaptation period. Test ration was given on

component – fed basis. Wheat straw was given ad. lib. Concentrate was given according to milk production of cows ie. 1 Kg. Concentrate mixture for every 3 Kg. Milk produced. The experimental diets were offered to the cows in 40:60 concentrate and roughage ratio. Concentrate and roughage fed as total mixed ration (TMR) prepared through Keenan Mechfiber machine.

Daily milk yield of per cow per day was measured the time of milking morning and evening by digital weighing balance and milk composition of each animal was determined on every day. The samples from morning and evening milking were pooled 200 ml. for each cow and were subjected to fat, S.N.F., protein, lactose, and acidity percents as per AOAC (2000).

Chemical composition of experimental diets:

The chemical composition of feed or total mixed rations used in experiment is presented in Table 3. Wheat straw contained 92.18, 91.46, 2.51, 2.14, 82.17 and 62.16 percent dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), neutral detergent fibre (NDF) and acid detergent fibre (ADF), respectively. Green maize contained 13.86, 89.51, 9.40, 1.72, 49.80 and 39.28 percent DM, OM, CP, EE, NDF and ADF, respectively. Barseem contained 18.17, 87.58, 16.20, 3.82, 42.03 and 22.78 percent DM, OM, CP, EE, NDF and ADF, respectively. Maize grain contained 94.26, 96.74, 9.36, 3.34, 25.21 and 8.47 percent DM, OM, CP, EE, NDF and ADF, respectively. Wheat bran contained 95.24, 93.27, 14.18, 3.73, 13.25 and 12.31 percent DM, OM, CP, EE, NDF and ADF, respectively. Rice polish contained 85.29, 87.47, 9.82, 10.34, 36.46 and 20.37 percent DM, OM, CP, EE, NDF and ADF, respectively. Groundnut cake contained 94.41, 94.45, 40.40, 7.37, 22.15 and 16.24 percent DM, OM, CP, EE, NDF and ADF, respectively. Mustard cake contained 92.04, 95.71, 38.33, 7.36, 25.05 and 23.30 percent DM, OM, CP, EE, NDF and ADF, respectively. TMR contained 32.40, 90.25, 12.41, 3.17, 61.28 and 38.16 percent DM, OM, CP, EE, NDF and ADF, respectively.

Table 3. Chemical composition (% DM) of feed used during lactation trial:

Feed	DM	OM	CP	EE	ASH	NDF	ADF
Wheat straw	92.18	91.46	2.51	2.14	8.28	82.17	62.16
Green Maize	13.86	89.51	9.40	1.72	10.48	49.80	39.28
Barseem	18.17	87.58	16.20	3.82	12.84	42.03	22.78
Maize Grain	94.26	96.74	9.36	3.34	2.57	25.21	8.47
Wheat Bran	95.24	93.27	14.18	3.73	6.67	13.25	12.31
Rice Polish	85.29	87.47	9.82	10.34	12.34	36.46	20.37
Groundnut Cake	94.41	94.45	40.40	7.37	6.02	22.15	16.24
Mustard Cake	92.04	95.71	38.33	7.36	5.48	25.05	23.30
TMR	32.40	90.25	12.41	3.17	9.82	61.28	38.16

Table.4. Mean values of different parameters

Mean values of parameters in different feeding intervals in different seasons												
Parameters	**Winter season**				**Summer season**				**Rainy season**			
	T 1	**T 2**	**T 3**	**Results**	**T 1**	**T 2**	**T 3**	**Results**	**T 1**	**T 2**	**T 3**	**Results**
Milk fat (%)	3.30	3.72	3.88	S	3.27	3.69	3.85	S	3.26	3.66	3.84	S
Milk SNF (%)	8.19	8.54	8.69	S	8.21	8.55	8.63	S	8.18	8.49	8.61	S
Milk protein (%)	3.27	3.58	3.59	S	3.26	3.60	3.58	S	3.26	3.57	3.56	S
Milk Lactose (%)	4.60	4.67	4.69	NS	4.61	4.68	4.70	NS	4.59	4.68	4.68	NS
Milk Acidity (%)	0.132	0.132	0.130	NS	0.135	0.133	0.132	NS	0.134	0.134	0.132	NS
Milk yield (Kg.)	6.26	6.92	6.45	S	5.36	6.10	5.40	S	3.93	4.70	4.00	S

Effect of feeding interval on milk components and milk yield in cows in winter season: The highest mean fat percentage was observed in milk of cows in T3 feeding interval (3.88) followed by the cows in T2 feeding interval (3.72) and T1 feeding interval (3.30). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk fat percent in winter season. The highest mean SNF percentage was observed in milk of cows in T3 feeding interval (8.69) followed by the cows in T2 feeding interval (8.54) and T1 feeding interval (8.19). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk SNF percent in winter season. The highest mean protein percentage was observed in milk of cows in T3 feeding interval (3.59) followed by the cows in T2 feeding interval (3.58) and T1 feeding interval (3.27). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk protein percent in winter season. The highest mean lactose percentage was observed in milk of cows in T3 feeding interval (4.69) followed by the cows in T2 feeding interval (4.67) and T1 feeding interval (4.60). The differences between the treatments were found non-significant indicating thereby a non-significant effect of feeding intervals on milk lactose percent in winter season. The highest mean acidity percentage was observed in milk of cows in both T1 feeding interval (0.132) and T2 feeding interval (0.132) followed by the cows in T3 feeding interval (0.130). The differences between the treatments were found non-significant indicating thereby a non-significant effect of feeding intervals on milk acidity percent in winter season. The highest mean milk yield was observed in cows of T2 feeding interval (6.95 Kg.) followed by the cows in T3 feeding interval (6.45 kg.) and T1 feeding interval (6.26 Kg). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk production in cows in winter season

Effect of feeding interval on milk components and milk yield in cows in summer season: The highest mean fat percentage was observed in milk of cows in T3 feeding interval (3.85) followed by the cows in T2 feeding interval (3.69) and T1 feeding interval (3.27). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk fat percent in summer season. The highest mean SNF percentage was observed in milk of cows in T3 feeding interval (8.63) followed by the cows in

T2 feeding interval (8.55) and T1 feeding interval (8.21). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk SNF percent in summer season.The highest mean protein percentage was observed in milk of cows in T2 feeding interval (3.60) followed by the cows in T3 feeding interval (3.58) and T1 feeding interval (3.26). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk protein percent in summer season. The highest mean lactose percentage was observed in milk of cows in T3 feeding interval (4.70) followed by the cows in T2 feeding interval (4.68) and T1 feeding interval (4.61). The differences between the treatments were found non-significant indicating thereby a non-significant effect of feeding intervals on milk lactose percent in summer season. The highest mean acidity percentage was observed in milk of cows in T1 feeding interval (0.135) followed by the cows in T2 feeding interval (0.133) and T3 feeding interval (0.132). The differences between the treatments were found non-significant indicating thereby a non-significant effect of feeding intervals on milk acidity percent in summer season. The highest mean milk yield was observed in cows of T2 feeding interval (6.10 Kg.) followed by the cows in T3 feeding interval (5.40 kg.) and T1 feeding interval (5.36 Kg). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk production in cows in summer season.

Effect of feeding interval on milk components and milk yield in cows in rainy season: The highest mean fat percentage was observed in milk of cows in T3 feeding interval (3.84) followed by the cows in T2 feeding interval (3.66) and T1 feeding interval (3.26). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk fat percent in rainy season. The highest mean SNF percentage was observed in milk of cows in T3 feeding interval (8.61) followed by the cows in T2 feeding interval (8.49) and T1 feeding interval (8.18). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk SNF percent in rainy season. The highest mean protein percentage was observed in milk of cows in T2 feeding interval (3.57) followed by the cows in T3 feeding interval (3.56) and T1 feeding interval (3.26). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk protein percent in rainy season. The highest mean lactose percentage was observed in milk of cows in both T3 feeding interval (4.68) and T2 feeding interval (4.68) followed by the cows in T1 feeding interval (4.59). The differences between the treatments were found non-significant indicating thereby a non-significant effect of feeding intervals on milk lactose percent in rainy season. The highest mean acidity percentage was observed in milk of cows in both T_1 feeding interval (0.134) and T_2 feeding interval (0.134) followed by the cows in T_3 feeding interval (0.132). The differences between the treatments were found non-significant indicating thereby a non-significant effect of feeding intervals on milk acidity percent in rainy season. The highest mean milk yield was observed in cows of T_2 feeding interval (4.70 Kg.) followed by the cows in T_3 feeding interval (4.00 kg.) and T_1 feeding interval (3.93 Kg). The differences between the treatments were found significant indicating thereby a significant effect of feeding intervals on milk production in cows in rainy season.

CONCLUSION

On the basis of results, it was

concluded that feeding interval did not have any positive effect on milk lactose and milk acidity in cross bred cows in all three seasons (winter, summer and rainy) but feeding interval has positive effect on milk fat, milk SNF, milk protein and milk yield in cross bred cows in all season like winter, summer and rainy. As we all know milk yield is an important factor for milk producers and milk components is economically important to milk producers and processors and nutritionally important to consumers so hence, to improve the milk components, milk yield, minimize the cost of animal feeds and to prevent wastage of animal feeds, farmers or milk producers can be advised for increased the feeding interval. Increased the feeding interval for cows has an important role play to make a dairy business profitable.

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Journal of Natural Resource and Development 13 (1) 39-42, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

DEVELOPMENT AND EVALUATION OF OYSTER MUSHROOM POWDER FORTIFIED NUTRITIOUS BISCUITS

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Received : 04.12.2017 Accepted : 06.03.2018

ABSTRACT

Mushrooms are highly nutritive, low calorie food with good quality protein, vitamins and minerals which are of paramount importance in the present age. Mushrooms are an important natural source of foods and medicines. A wide range of activities including antitumour, cardiovascular are reported in mushrooms. Because of having high fibre, low fat and low starch, edible mushrooms have been considered to be ideal food for obese persons and for diabetics. They are also known to possess promising, cardiovascular, hypercholesterolemia, antimicrobial, hepato-protective and anticancer effects. The aim of this study was to develop oyster mushroom fortified nutritious biscuits and its nutritional quality evaluation. In this study, organoleptic evaluation of prepared biscuits revealed that on the basis of overall acceptability score (8.3), T3 (15%) fortification of mushroom powder in biscuits was liked very much than other developed combinations. Further nutritional analysis reported that T3 (15%) mushroom (Oyster mushroom) fortified biscuits contain high amount of protein and fibre, low fat and carbohydrate than control sample. It was concluded that prepared mushrooms fortified nutritious biscuits are considered as healthy food because they are good in carbohydrate and fat but rich in protein and fiber contents and also good in organoleptic qualities.

Key words : *Antitumour, cardiovascular, antimicrobial, anticancer effects, antioxidative, nutritional analysis, organoleptic acceptability.*

INTRODUCTION

Mushrooms are a common vegetable product that has also been linked to pharmaceutical and medicinal uses. The incorporation of mushroom in ready-to-eat snack foods may be of considerable interest to the food industry in trying to regulate the glycemic response of foods (Brennan et al., 2012). Mushrooms have been recognized as most loved vegetarian food, rich in nutrition, particularly protein. With their flavour, texture, nutritional value, very high

productivity per unit area and time, less dependence on land and ability to grow on a variety of residual agricultural wastes, mushrooms have rightly been identified as a food source to fight malnutrition in developing countries (Dutta, 2007). Both wild and cultivated mushrooms have been consumed by humans for their nutritional and medicinal benefits.

Nutritionally, mushrooms are low in energy and fat but high in protein, carbohydrate, and dietary fibre. Mushrooms contain a variety of minerals and trace elements such as potassium, and copper and vitamins such as riboflavin, niacin, and folates. They have been used as food for centuries because of their unique taste (Cheung, 2010). In dried oyster mushroom (Pleurotus ostreatus) have energy value 345 Kcal, water content 10.6%, protein 15.7%, fat 2.66%, carbohydrate 64.1% and ash 7.04%. The proteins of mushroom are of high quality and rich in various essential amino acids (Julita and Marek, 2007). Apart from being recognized as a nutritious food, certain mushrooms are also an important source of biologically active compounds with potential additional medicinal value in Chinese medicine. Bioactive secondary metabolites found in mushrooms include phenolic compounds, sterols and tri terpenes. Studies with mushrooms and isolated bioactive constituents have purported many pharmacological effects such as anti-tumour, antioxidant, antiviral, hypocholesterolemic and hypoglycaemic effects. Consumption of mushrooms or mushroom products in our daily diet may provide health benefits (Cheung, 2010).

MATERIALS AND METHODS

1. Development of biscuits: - Fortified biscuits was prepared in which wheat flour was replaced by mushroom powder at different rates as 5percent, 10 percent,15 percent and 20 percent

- Dry ingredients like wheat flour/mushroom powder, baking soda and baking powder were mixed.
- Sieved twice for uniform mixing.
- Milk powder was added to the flour mixture.
- Oven was pre heated at 180o C for 15 minutes.
- Weighed amount of cholesterol free butter was taken in a bowl and stirred until it melts; sugar was added and stirred continuously for creaming.
- Flour was added in smaller amounts into the cream and uniformly mixed. Soft dough was prepared by sprinkling small quantity of water and kept it for some time (5 minutes).
- Again dough was rolled and then biscuits were cut into small round shape using biscuit cutter and kept in greased baking tray.
- Baking tray with biscuit was kept in an electric oven for 30 min at 125oC for uniform baking.

2. Sensory Evaluation:-The prepared samples were analysed for organoleptic evaluation by 9-point hedonic scale as taste and flavour, texture, colour and appearance and overall acceptability.

3. Nutritive Value of prepared products:- The prepared samples were analysed for nutritive value as protein, crude fat, carbohydrate, crude fibre and total ash.

4. Statistical Method: - The data obtained in the present investigation were tabulated statistically by using CRD (Completely Randomized Design).

RESULTS AND DISCUSSION

The sample was analysed periodically for organgnoleptic acceptability and nutritive value.

Organgnoleptic Acceptability: Mean score of control sample was 9.0 while the mean value of

T_1 (5%), T_2(10%), T_3(15%) and T_4(20%) mushroom fortified biscuits were 7.6, 8, 8.8 and 6.6 respectively in taste and flavour. T3 (15%) fortified product mean score (8.8) shows better taste and flavour than other fortified products. The results from showed that control and fortified products's body and texture were non significant at the level of 5 percent in critical difference. The mean score of T3 (15%) fortified sample was higher (8.2) than others which shows that its texture was better than control and others. Mean score colour and appearance profile of control sample revealed that 9.0 whereas value obtained by T_1(5%), T_2(10%), T_3(15%) and T_4(20%) mushroom fortified biscuits were 7.8, 7.8, 8.0 and 7.4 respectively. T3 (15%) fortified product mean score (8.0) shows better taste and flavour than other fortified products. Mean score of overall acceptability obtained by organoleptic evaluation between control and fortified sample. The result shows that the mean value of overall acceptability of T3 (15%) fortified product got highest mean score (8.3) than other fortified products. The overall organoleptic acceptability of different samples of biscuits was show that 15 percent mushroom fortified biscuits had better sensory characteristic than other fortified samples (Figure 1).

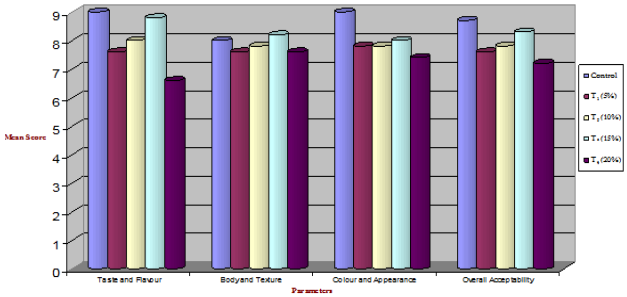

Figure:1. MEAN SCORE OF ORGANOLEPTIC EVALUATION OF MUSHROOM FORTIFIED BESAN LADDUS

Nutritional evaluation: Table 1 shows that meanSD values of developed mushroom fortified nutritious biscuits was 5.240.03g, 9.60.01g, 2.90.06g, 1.590.02g, 1.600.03g and 61.820.24g per 100g for moisture, crude protein, crude fat, total ash, crude fibre and carbohydrate respectively compare that control.

Table 1: Mean Score of Nutritive Value of Mushroom powder Fortified biscuits (g per 100g).

Sl. No.	Study Group Products	Nutrients					
		Moisture	Crude Protein	Crude Fat	Crude Fibre	Total Ash	Carbohydrate
1.	Control	5.98±0.05	9.0±0.13	3.4±0.03	0.63±0.04	1.61±0.12	63.44±0.23
2.	Developed biscuits (T_3)	5.24±0.03	12.6±0.01	2.9±0.06	1.60±0.03	1.59±0.02g	61.82±0.24

Now different types of biscuits are prepared and consumed by using different type of nutritious ingredients because of their unique taste and nutritional quality. In present study, nutritious biscuits were prepared by using oyster mushroom powder and because of its sensory and nutritious qualities it is suggested for adults, old persons and children. Smiderle et al. (2008) revealed that production and consumption of mushrooms have grown in the world, and beside these, the nutritional properties and biological active components of fungi have received more attention by researchers. Further Strmiskova et al. (2010) reported that oyster mushroom (Pleurotus ostreatus) belongs to the best known wood-destroying fungi. In the nature it grows on trunks and stumps of deciduous trees but nowadays it is also cultivated on modified lignocellulose substrates in oyster mushroom farms. In the past mushrooms were generally regarded as less valuable foodstuffs especially for their low energetic value and high fibre content.

In a study supplementary foods like food mixtures (Multipurpose powders), Sweet Balls (Laddoos), Cookies (Biscuits), Sweet Buns (Round bread) by incorporating oyster mushroom power (Pleurotus sajor-caju) in the basic ingredient were developed. The findings of the acceptability trials revealed that there was no significant difference between control

and experimental foods. The substitution of mushroom powder also showed significant contribution of amino acids and increases the Biological Value and Digestibility Coefficient. Hence the developed supplementary foods are recommended in the diet of vulnerable groups to overcome protein malnutrition (Mane et al., 2000).

CONCLUSION

Numerous mushroom-based 'healthy' products for direct use are available on the market; many patents propose use of medicinal mushrooms and/or their products as additives to food. This seems to be a very convenient and simple method for delivering healthy ingredients to the consumers and, at the same time, enhancing the flavor of the food products. The nutrient analysis of nutritious biscuits revealed that the nutritive value of product can be increased with fortification of mushroom at different increasing level and organoleptic acceptability of fortified biscuits were analysed by panel members and concluded that T3 (15%) mushroom fortified biscuits had better sensory characteristic than other fortified samples. It was concluded that prepared mushrooms fortified nutritious biscuits are considered as healthy food because they are good in carbohydrate and fat but rich in protein and fiber contents and also good in organoleptic qualities. So, it is prescribed for growing children, pregnant and lactating women, old persons also for vegetarian which require high protein diet and also recommended for diabetic, obese, heart patients who require less amount of fat.

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Journal of Natural Resource and Development 13 (1) 43-64, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

EVALUATION OF HEAVY METAL POLLUTION BASED ON MULTIVARIATE CONTAMINATION INDICES AND FACTOR ANALYTIC APPROACH IN THE RIVER GANGA WATER AND SEDIMENTS FROM UPSTREAM TO DOWNSTREAM IN GHAZIPUR STRETCH, UTTAR PRADESH, INDIA

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Received : 05.04.2018 *Accepted : 06.05.2018*

ABSTRACT

The elevating levels of the heavy metals in the river Ganga at Ghazipur could eventually contaminate the riverine aquaculture and thus making them noxious for human consumption. In the present study, heavy metal concentrations were found within the permissible limits of WHO water quality standards. Cd and Cr concentrations were found close to acceptable limits for potable water. Heavy metal concentration in sediments was estimated higher than USPHS standards during summer seasons viz., Cu (46.32 mg/kg at Gh1) and Cu (47.65 mg/kg at Gh2), Zn (102.53 mg/kg at Gh2 and 173.56 mg/kg at Gh3). Pearson's correlation matrix for heavy metal concentrations in the river water revealed various interrelationship between metal. Cluster analysis elucidated similarity in different study sites in different seasons. Maximum PLI was found at Gh2 which is less than one, it reveals anthropogenic interferences are higher at midstream than that of at the upstream and downstream of the river Ganga at Ghazipur. RI confirmed low grade of ecological risk at the three sampling stations. On the basis of highest eigenvalue, two components are extracted in both river water and bed sediments, where, PC1 is dominant by strong factor loadings for Cu (0.917), Cr (0.913), Cd (0.906), Pb (0.835), Ni (0.826) and Zn (0.600) for the river water and, PC1 has all strong factor loadings Cd (0.995), Cu (0.990), Ni (0.989), Cr (0.979), Zn (0.973) and Pb (0.970) for heavy metals in sediments. Regular monitoring programs for the heavy metals is suggested to protect these water bodies and also to decrease environmental risk.

Key words : *River Ganga; heavy metals contamination; Ghazipur; multivariate study.*

INTRODUCTION

Water is the obligatory compound for sustaining life and conserving biodiversity on earth (Ramesh et al. 1990; Singh et al. 2013a). River water columns are the most important fresh water resources and are also used for recharging ground water tables, hydro power generations, shipping, domestic purposes from inhabitants, industrial utilizations and waste diluters as well, irrigation purposes and agricultural runoff, etc, (Kumar et al. 2015; Dong et al. 2003; Bharose et al. 2013; Jain et al. 2004; Singh et al. 2013b; Pandey et al. 2010). Rapid urbanization allied with economic and industrial developments to fulfill the unlimited increasing population's demands have arrested the quality of riverine ecosystems (C.P.C.B. 2011; Bharose et al. 2013; Jain et al. 2004; Kotoy et al. 1997). Spontaneous industrialization and excessive use of synthetic fertilizers often contribute to the entrance of heavy metals into rivers bodies beyond the threshold limits (Bharose et al. 2013; Moore et al. 1979; Raju et al. 2012; Singare et al. 2011; Singh et al. 1997).

Heavy metals are persistent in nature, and once entered into river water, it may concurrently succeed in river sediments through adsorption and absorption (Bhattacharya et al. 2008; Hasan et al. 2016; Chen et al. 2004; Marthe et al. 2011; Ramesh et al. 1990; Singare et al. 2011). Disproportionate discharge of heavy metals may make sediments as non point source reservoir of heavy metals which may retain it back into the river water as a function of factors (Chen et al. 2004, Ideriah et al. 2012; Kotoy et al. 1997; Marthe et al. 2011). The inconsistent presence of heavy metals is also bio-available and thus, may get integrated its concentrations in aquatic biota leading to biomagnification (O¨ zkan 2012). Incorporated heavy metals may compound deleterious and lethal effects to the aquatic biota and also to the people rely on them (Mohiuddin et al. 2010; O¨ zkan 2012; Ramesh et al. 1990; Singh et al. 1999).

The present study accounts for the heavy metals load in river ecosystem of the river Ganga, which serves the largest basin (26.3%) of the Indian subcontinent.

River Ganga originates from the southern slopes of the western Himalayan ranges (30° 55′ N, 79° 7′ E) (C.P.C.B. 2016). Inflowing the plains at Hardiwar, it streams its way to the Bay of Bengal while covers 2,500 km through the provinces of Uttar Pradesh, Bihar and West Bengal (C.P.C.B. 2013). After serving many big and small cities in its meanwhile flow, the quality of a river at any location imitate several major influences, counting the lithology of the river basin, atmospheric inputs, climatic conditions and anthropogenic activities (Singh et al. 2013b). Most of the STPs built under the Ganga Action Plan are ineffective for the treatment of the heavy metal toxins and thus, the even treated waters released into the river remain toxic (C.P.C.B. 2013; 2015).

The discharge of untreated or partly treated industrial waste waters containing heavy metals into the water bodies. Agricultural cultivation alongside the bank of rivers also adds Heavy metals contained in fertilizers and pesticides enter water bodies through settling of airborne soil particles.

The industrial outburst, drainage from the profuse use of fertilizers in agricultural ecosystems, medicinal waste, mining and domestic wastes are the main sources of heavy metal pollution in the river Ganga (Singh et al. 2014). Industrial pollution is far attaining implication. A large number of industries like dyeing, tanning, printing and battery manufacturing units operate alongside the rivers and discharge their effluents into it. Chromium, cadmium, arsenic, mercury,

nickel, sulfide ammonium and other salts, chemical dyes, sulfuric acid and methane are the main discards of Tannaries. CPCB Report (2006) revealed these industries are responsible for increase its concentration of chromium at Kannuaj, Kanpur and Varanasi up to ten folds within a few years. Fertilizer industries have in fluxed Arsenic in the river Ganga and its tributaries in large amount in the stretch from Bihar to West Bengal.

Huge amount of Heavy Metal influxes to rivers consequence the amplification in the level of metal concentration in sediments and river water is significantly exceeding from those originating from the natural resources in the river Ganga. Heavily populated and important cities like Haridwar, Kanpur, Allahabad, Varanasi, Ghazipur, Ballia, Patna, etc are situated on the banks of the river Ganga. The river Ganga during their meandering obtain a wide array of chemical constituents, including toxicants from a variety of natural and anthropogenic sources. The quality of water of the river Ganga is continuously declining as there is an unremitting influx of objectionable chemicals, while the demand of potable water is on a climb.

Several scientific studies are perfomed on heavy metals concentrations in water bodies all over the world (Saha et al. 2012; Salah et al. 2012; Seralathan 1987; Singare et al. 2011; Wang et al. 2011; Biksham et al. 1991). In present investigation, assessment of monitoring data using multivariate statistical techniques, like principle component analysis coupled with metal concentration analysis (in the river water and river bed sediments) and correlation analysis, and cluster analysis of the river Ganga (water and freshly deposited sediment) at Ghazipur, district, Uttar Pradesh has been performed. In addition, several interpretative tools for the numerical analysis of sediment quality have been used such as contamination factor (CF), contamination degree (CD), pollution load index (PLI), geo-accumulation index (Igeo) and ecological risk index (RI).

Study area

Ghazipur is an under developed district of eastern Uttar Pradesh State, located along the left bank of river Ganga 75 km downstream to Varanasi in middle Gangetic plain (Fig 1).

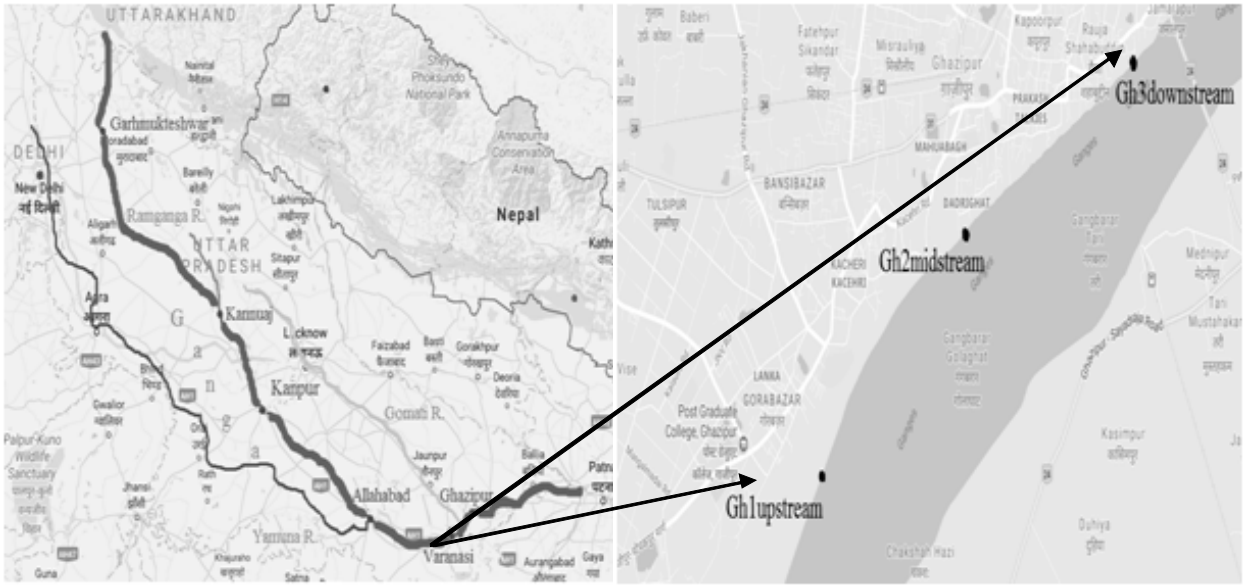


Figure 1. Map showing the sampling stations of the river Ganga at Ghazipur (Map not to the scale).

Sites	Latitude	Longitude	Elevation
Gh1upstream	25°32'44 N	83°32'61 E	19058 ft
Gh2midstream	25°33'49 N	83°33'42 E	19042 ft
Gh3downstream	25°34'35 N	83°34'56 E	19040 ft

Table 1. Geographical co- ordinates of sampling sites of the river Ganga at Ghazipur.

The city lengthens between 25°19'N to 25°54'N latitude and 83°4'E to 83°58'E longitude. According to the Census Statistics 2011, the population of Ghazipur (total coverage area is about 3,384 km2) was 3,622,727.

The city is well-known for having the prime legal opium factory in the world, in addition, multi-productive agro-manufacturing unit, alcohol manufacturing unit, polythene manufacturing units, leather tanning, small textile units, laundry chemicals, paints and dyes, radiators, brake wires, tire wear, anticorrosive plating are main supplier of heavy metal contamination in the river.

Sampling sites descriptions

The present research work was planned in two successive phases, first phase includes a comprehensive survey to collect the water and sediment samples and in a second phase, the samples were organized the laboratory analysis. Three sampling locations were chosen as Ghazipur city for the study purposes viz. upstream (Gh1), midstream (Gh2) and downstream (Gh3). The geographical coordinates of the study stations are mentioned in Table 1. Gh1 was located at the upstream of river Ganga when it enters the Ghazipur city, this sampling spot was close a very famous holy place named as Bada Mahadeva Ghat. Domestic open and closed wastewater drains from the residential habitations plus effluent from nearby located Land's distillery generate water and sediment metal contamination in Ganga. Gh2 was situated in the mid portion of the city and thus, receives pollutants from untreated domestic waste, incorporated and industrial effluent from the world eminent and licensed Government Opium and Alkaloids unit. Gh3 is situated near the old ghat of the river Ganga in Ghazipur i.e., Chitnath ghat. This spot lies along the downstream and exit point of the river Ganga from the city. It is least populated area of the city, but influenced by the pollutant load imminent from the upstream and midstream area of the river Ganga in Ghazipur.

Sample collection

Sampling cans were rinsed with de-ionized water and soaked in 3% HNO3 for 24 hours before sampling. The bottles were dipped up to 15 to 30 cm into the river water and capped tightly after being filled. The water samples were kept with ice packs in a Thermocol box till they were being transported to the laboratory for experimentation. All glass wares and containers were cleaned by 10% nitric acid, and rinsed with De-ionized distillated water.

The freshly deposited sediment samples were collected from 10 to 15 cm depth of the bank of the flowing water channel into impenetrable polythene bags as 500 gm from each sampling station. All the collected samples were transferred to the laboratory and firstly were air dried for 72 hrs. After drying the sediment, it was homogenized by grinding it in a total mortar and then sieved to <63 μm sediment fraction.

Sample analysis

Samples were collected in three consecutive seasons during the session 2015-2016 viz., during summer season (March - April), during monsoon period (July - August) and during winter season (December -

January). For heavy metals analysis in water, water samples (50ml) were digested with 10ml of conc. HNO3 at 80 C until the solution became transparent. The solution was filtered through Whatman no. 42 filter paper and diluted to 50ml with double distilled water. After digestion water samples were analyzed for six metals, namely Cu, Cr, Cd, Pb, Zn and Ni using Atomic Absorption Spectrophotometer (Perkin-Elmer model 800, USA).

For heavy metal analysis in sediment samples, sediment sample (2 gm) was heated with 20 ml of tri-acid mixture (HNO3, H2SO4 and HClO4) in the proportion of 5:1:1 in a Teflon measuring beaker at 80 C for 4–5 hrs. When the solution turned transparent, the sample was cooled to room temperature. The solution was filtered through Whatman No. 42 filter paper into a cleaned 100ml volumetric flask. The filtrate was analyzed for six heavy metals (Cu, Cr, Cd, Pb, Zn and Ni) estimation through Atomic Absorption Spectro-photometer (Perkin-Elmer model 800, USA).

Statistical analysis, pollution indices, cluster analysis, principle component analysis

Pearson's Correlation

Correlation is a technique used to appraise the degree of associations between the variables and it shows the overall coherence of the data. A systematic study of correlation coefficients assists to evaluate the overall water and sediment quality and also quantifies the relative concentration of various pollutants. The correlation between variables in the range of +0.8 to 1 and -0.8 to -1 is illustrated as strong, in the range of +0.5 to 0.8 and -0.5 to -0.8 as moderate, and in the range of +0.0 to 0.5 and -0.0 to -0.5 as weak. Numerous researchers have applied Pearson's correlation coefficient to study the interrelationships of different variables.

Contamination factor and Contamination degree

Contamination factor (CF) is an arithmetic indicator and a global standard reference for metal concentrations in sediments. It is determined by comparing the mean of trace metal concentration with average shale concentration given by (Turekian and Wedepohl 1961).

CF = Observed metal Concentration / Background concentration of the same metal

CF values have been classified into four ratings, i.e., CF < 1 in class 1 with low CF, 1 ≤ CF <3 in class 2 with moderate CF, 3 ≤ CF < 6 under class 3 with considerable CF and CF ≥ 6 reserved in class 4 with extremely high CF.

Contamination degree (CD) is the addition of all the CF values of a specific sampling site. It is also classified in settings of four ratings of sediments, i.e. CD < 6 comes under the class 1 and demonstrates low CD, 6 ≤ CD < 12 follows the class 2 it confirms moderate CD, 12 ≤ CD < 24 pursue the class 3 it illustrates significant CD and CD ≤ 24 follows the class 4 with incredibly high CD (Ahdy and Khaled 2009).

The Contamination factor (CF) and Contamination degree (CD) are used to evaluate the pollution load of the sediments regarding heavy metals.

Pollution load Index (PLI)

Tomlinson et al. (1980) introduced Pollution load index for the estimation of the extent of heavy metals contamination in sediments. Each site was the method proposed by Tomlinson et al. (1980). The PLI for a site is determined by an equation which is the nth root of n number multiplying the contamination factors (CF) together.

$$PLI = \sqrt[n]{(CF1 * CF2 * CF3 * \ldots \ldots \ldots CFn)}$$

Where CF is the contamination factor and n is the number of parameters. Further, its values were divided following grades i.e.,PLI = 0 specify a perfect state of pollution; PLI = 1 point indicates only baseline levels of pollutants, presence and PLI >1 would indicate increasing

deteriorating condition of the sites.

Potential ecological risk index (RI)

Ecological risk assessment is an investigative tool related to the standardized heavy metal toxic factor specified by Hakanson (1980). It is a logical viewpoint to appraise the characteristics and environmental behavior of heavy metal contamination in sediments. RI estimates the degree to which the sediment-associated chemical category may negatively influence aquatic organisms.

The index is calculated as the following equations:

$$RI = \Sigma Ei \quad , \quad Ei = Ti * CF$$

Where RI is computed as the sum of all risk factors in the sediments, Ei is the monomial potential ecological risk factor for individual factors, and Ti is the metal toxic factor.. CF is the contamination factor.

Hakanson (1980) also recommended the categorization related to RI followed by; RI < 65 explicates low risk, RI = 130 to 260 shows substantial risk, whereas, RI > 260 reveals very high risk.

Geo-accumulation index

Muller (1981) proposed a general standard to estimate the anthropogenic impact associated with the heavy metal contamination in sediments is the geo-accumulation index (I geo). The equation used to calculate I geo is

$$Igeo = \log2 [Cn / 1.5Bn]$$

Where, Cn is the measure of the element "n" in the sediment and Bn is the geochemical background concentration given by Turekian and Weedpohl (1961). The factor 1.5 is included in the relationship to describe the possible difference in back- ground data due to the lithogenic effect (Taylor 1964).

It consists of seven scores (0–6) demonstrating a variety of degrees of metal enhancement beyond the average shale value. The scores are classified as follows: Class 0 (unpolluted sediment): Igeo ≤ 0; Class 1 (unpolluted to moderately polluted sediment): 0 < Igeo < 1; Class 2 (moderately polluted sediment): 1< Igeo < ; Class 3 (moderately to strongly polluted sediment): 2 < Igeo < 3; Class 4 (strongly polluted sediment): 3 < Igeo < 4; Class 5 (strongly to extremely polluted sediment): 4 < Igeo < 5; Class 6 (extremely polluted sediment): 5 < Igeo. Class 6 is an open class and includes all standards of the index elevated than class 5.

Cluster analysis

Cluster analysis is an investigation data analysis tool that covers different algorithms and methods for sorting different objects into respective categories of maximal similarity. Various parameters from diverse samples are compared by clustering them according to their similarity by means of linkage method. In current paper Ward's method has been used to link the closure by samples with an ANOVA approach to determine the distance between clusters. The greatest similarity can be seen in initial clusters. The horizontal axis in the dendrogram represents the linkage distance. Thus, for each joint a new cluster is created. The standard distance can be read off where the exact elements were connected together into a cluster. Similarities and dissimilarities are the set of rules that offers a principle for cluster formation.

RESULT AND DISCUSSION

Assessment of heavy metal concentrations in the river water

In the present research, the average concentrations of metals in the river water were estimated in the following increasing order: Cd < Pb < Ni < Cr < Zn < Cu. The estimated heavy metal concentrations in the river water at each site Gh1, Gh2, and Gh3 is demonstrated in Table 2. The average concentrations of Cu were evaluated as 0.029 ± 0.004 mg/l, 0.035 ± 0.0025 mg/l and 0.030 ± 0.0015 mg/l at Gh1, Gh2 and Gh3 respectively. Maximum

concentration of Cu was recorded as 0.038 mg/l during summer at Gh2, while its minimum values were estimated 0.024 mg/l at Gh1 during monsoon season.

Table 2. Distribution of heavy metal concentrations in the river water of Ganga at Ghazipur

	Heavy metal concentrations in the river water (mg/l)	Summer season	Monsoon season	Winter season	Mean ± SD	Permissible limit	International standards
Gh1upstream	Cu (mg/l)	0.033	0.024	0.031	0.029 ± 0.004	1	WHO
	Cd (mg/l)	0.003	0.001	0.002	0.002 ± 0.001	0.005	WHO
	Cr (mg/l)	0.011	0.004	0.009	0.008 ± 0.003	0.05	WHO
	Zn (mg/l)	0.032	0.03	0.024	0.028 ± 0.004	5	WHO
	Ni (mg/l)	0.017	0.006	0.011	0.011 ± 0.005	0.1	WHO
	Pb (mg/l)	0.011	0.005	0.008	0.008 ±0.003	0.05	WHO
Gh2midstream	Cu (mg/l)	0.038	0.033	0.036	0.035 ± 0.0025	1	WHO
	Cd (mg/l)	0.004	0.002	0.003	0.003 ± 0.001	0.005	WHO
	Cr (mg/l)	0.035	0.007	0.022	0.021 ±0.014	0.05	WHO
	Zn (mg/l)	0.039	0.036	0.033	0.036 ± 0.003	5	WHO
	Ni (mg/l)	0.019	0.008	0.02	0.015 ± 0.006	0.1	WHO
	Pb (mg/l)	0.02	0.005	0.009	0.011 ± 0.007	0.05	WHO
Gh3downstream	Cu (mg/l)	0.032	0.029	0.03	0.030 ± 0.0015	1	WHO
	Cd (mg/l)	0.002	0.001	0.001	0.001 ± 0.0005	0.005	WHO
	Cr (mg/l)	0.019	0.007	0.017	0.014 ±0.006	0.05	WHO
	Zn (mg/l)	0.032	0.031	0.021	0.028 ± 0.006	5	WHO
	Ni (mg/l)	0.016	0.015	0.014	0.015 ± 0.001	0.1	WHO
	Pb (mg/l)	0.017	0.007	0.01	0.011 ±0.005	0.05	WHO

Table 3. Distribution of heavy metal concentrations in the river bed sediments of Ganga at Ghazipur

	Heavy metal concentrations in the river bed sediments (mg/kg)	Summer season	Monsoon season	Winter season	Mean ± SD	Permissible limit	International Standards
Gh1upstream	Cu (mg/kg)	46.32	27.71	38.63	37.55 ± 9.3	45-50	USEPA
	Cd (mg/kg)	0.5	0.23	0.38	0.37 ± 0.135	1	USPHS
	Cr (mg/kg)	180.11	102.42	132.36	123.26 ± 49.81	500	UNEP
	Zn (mg/kg)	90.4	48.47	83.51	74.12 ± 22.48	100	USPHS
	Ni (mg/kg)	30.64	17.22	23.41	23.75 ± 6.71	50	USPHS
	Pb (mg/kg)	18.86	10.52	14.64	14.67 ± 4.17	35.8	USEPA
Gh2midstream	Cu (mg/kg)	47.65	28.43	39.52	38.53 ± 9.6	45-50	USEPA
	Cd (mg/kg)	0.56	0.26	0.41	0.41 ± 0.15	1	USPHS
	Cr (mg/kg)	193.89	112.57	148.87	151.77 ± 40.73	500	UNEP
	Zn (mg/kg)	102.53	51.87	87.25	80.55 ± 25.98	100	USPHS
	Ni (mg/kg)	36.32	19.69	26.62	27.54 ± 8.35	50	USPHS
	Pb (mg/kg)	21.34	13.2	18.92	17.82 ± 4.18	35.8	USEPA
Gh3downstream	Cu (mg/kg)	44.37	26.34	36.85	35.85 ± 9.0	45-50	USEPA
	Cd (mg/kg)	0.51	0.24	0.36	0.37 ± 0.13	1	USPHS
	Cr (mg/kg)	173.56	106.34	127.76	135.88 ± 34.33	500	UNEP
	Zn (mg/kg)	91.69	47.67	80.66	73.34 ± 22.90	100	USPHS
	Ni (mg/kg)	32.54	16.87	24.68	24.68 ± 7.83	50	USPHS
	Pb (mg/kg)	19.21	10.23	17.22	15.55 ± 4.7	35.8	USEPA

Cu is an essential element which is required in trace amount for some enzymatic activities in metabolic activities. High concentrations of Cu in surface water can severely affect aquatic plants, invertebrates, fishes and also humans (Singh et al. 2017). In the river Gandak, which is one of the major tributaries of the river Ganga in north India belt, Singh and Shukla (2016) found the maximum concentration of Cu (0.025 mg/l) in the river water at Sahibganj (Bihar, India) in the year 2015-16 which was below the permissible limit of 0.05mg/L set by WHO. Sharma et al. (2012) determined low concentrations of Cu than the present study at Narora Barrage (36 µg/l) and Jajmau, Kanpur (10 µg/l) in the river Ganga water.

Cr concentrations in the river water were analyzed 0.004 mg/l minimum at Gh1 during monsoon season, whereas, maximum Cr concentration was found 0.035 mg/l at Gh2 during summer season. The mean values of Cr were evaluated as 0.008 ± 0.003 mg/l, 0.021 ±0.014 mg/l and 0.014 ±0.006 mg/l correspondingly at Gh1, Gh2 and Gh3. Cr subsists into two stable states trivalent Cr(III) and hexavalent Cr(VI), in which Cr(VI) is more toxic because of its higher oxidative potential (Gupta et al. 2017). Ali et al. (2016) also performed a research on heavy metal fluxes in surface water of the river Karnaphuli, Bangladesh and reported that the average concentrations of Cr were exceeding the WHO permissible limits. In a research regarding heavy metal concentrations in the river water of Gandak in Bihar, India Singh and Shukla (2016) detected Cr only from Sonepur Bridge as 0.004 mg/l in the year 2015- 16 and authors notified that Cr concentration were not detected at other sites of Bihar, India.

Cd was recorded highest 0.004 mg/l at Gh2 during summer season, whilst, the lowest value of Cd was estimated 0.001 mg/l at Gh1 and Gh2 during monsoon season. Average concentrations of Cd in the river water of Karnaphuli were estimated above the safe water standards given by WHO (Ali et al. 2016). Cd is also formed as a byproduct of Zn refining, and in addition, is used and released in effluent during batteries manufacture, metal coating, electroplating etc,. (Gupta et al. 2017). In the river Gandak the maximum concentration of Cd in stream was noted as 0.034 mg/l at Sonpur Bridge in the year 2014- 15, which is above the permissible limits set by WHO (0.01 mg/l) (Singh and Shukla, 2016). Cd concentrations were reported above the acceptable limits of WHO at Narora Barrage, Bithoor (Kanpur) and Jajmau (Kanpur) in the river Ganga (Sharma et al. 2012)

The average values of Pb were found as 0.008 ±0.003 mg/l, 0.011 ± 0.007 mg/l and 0.011 ±0.005 mg/l at Gh1, Gh2 and Gh3 respectively. Its peak value of Pb was recorded as 0.02 mg/l during summer season at Gh2 and the lowest value of Pb was found as 0.005 mg/l during monsoon season at Gh1 and Gh2. Pb is a non-essential element and can produce harmful effects at very low concentrations (Pandey and Singh, 2015) Pb concentrations were also traced by Ali et al. (2016) in the river water of the river Karnaphuli and the values were reported more than acceptable limits of WHO standards. Bhattacharya et al. (2008) reported maximum Pb concentrations during monsoon season 0.058µg/l in the river Ganga in West Bengal.

The maximum value of Zn concentration in the river water was estimated 0.039 mg/l during summer season at Gh2 and its lowest concentration was recorded as 0.021mg/l during the winter season at Gh3. Singh et al. (2005) found Zn concentrations in the range of 0.0144-0.0298 mg/l in the river water of the river Gomati in a 500km long stretch from Neemsar to Jaunpur in Uttar Pradesh, India.

Mean values of Ni were measured as

0.011 ± 0.005 mg/l, 0.015 ± 0.006 mg/l and 0.015 ± 0.001 mg/l at Gh1, Gh2 and Gh3 respectively. Maximum values of Ni were recorded 0.019 mg/l at Gh2 during summer season, although, minimum Ni concentration was analyzed 0.006 mg/l at Gh1 during monsoon. Singh and Shukla (2016) recorded the maximum concentration of Ni as 0.034 mg/l in the river water of Gandak at Sonepur Bridge, Bihar, India in the year 2015-16.

Metal concentrations were found under the permissible standards given by WHO, 2004 on the river during the three seasons at all the study sites. Cd and Cr concentrations were found close to acceptable limits and were recorded accelerating at Gh2 (Fig 2 (A)) . If sufficient wastewater treatment is not made available the concentrations may exceed the limits of international standards.

Pearson's correlation matrix for heavy metal concentrations in the river water (Table 4) revealed various interrelationship between metal. A strong association between the metals in the river water imitate related sources of pollution, interdependence, and behaviors of metals during transportation. Cd is strongly associated with Cu ($r = 0.884$, $p < 0.01$) and Cr ($r = 0.784$, $p < 0.01$) while moderate associations was observed in Ni-Cr ($r = 0.755$, $p < 0.05$), Pb - Ni ($r = 0.676$, $p < 0.05$).

Table 4. Pearson's Correlation For The Heavy Metal Concentrations of The River Ganga Water

	Cu	Cd	Cr	Zn	Ni	Pb
Cu	1					
Cd	.884**	1				
Cr	.784*	.731*	1			
Zn	.539	.645	.384	1		
Ni	.739*	.643	.755*	.264	1	
Pb	.617	.638	.861**	.351	.676*	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Cluster analysis elucidated similarity in different study sites in different seasons (Fig 3 (C)). Two clusters are formed in which first cluster is produced with two subgroups, first subgroup has Gh1, Gh2 and Gh3 during monsoon season, which concludes similar concentrations of metals during monsoon season at all the three sites. Similarly, second subgroup is comprised of Gh1, Gh2 and Gh3 during winter seasons. A second cluster is comprised of Gh1, Gh2 and Gh3 during summer season, it shows more distance in comparison to the first two subgroups. CA of heavy metal concentrations in river water suggests seasonal variations in concentrations, where, metal concentrations were more similar at sites during monsoon and winter seasons in comparison to that of during summer season.

Assessment of heavy metal concentrations in the river bed sediments

The measured estimations of heavy metal concentrations in sediments at each site Gh1, Gh2, and Gh3 are demonstrated in Table 3. Average metal concentrations in river bed sediments pursued the following increasing trend: Cd < Pb < Ni < Cu < Zn < Cr. Highest metal concentrations were investigated at Gh2 during summer season.

Cu was estimated greatest at Gh2 during summer season (47.65 mg/kg) its lowest values were traced at Gh3 i.e., 26.34 mg/kg during monsoon season. Average values for Cu lounge below the permissible

limits given by USEPA, 1999 (50 mg/kg). Excessive use of fungicides, algaecides, molluscicides, insecticides, etc, attribute the Cu pollution in environment (Gupta et al. 2017). Singh et al. (2017) assessed heavy metal concentrations in the sediments of one of the major tributaries' river Ghaghara' of the river Ganga and reported Cu concentrations in the range from 2.73 to 11.74 mg/kg in northern India.

Cr concentrations ranged between 102.42 mg/kg (at Gh1 during monsoon season) to 193.89 mg/kg (at Gh2 during summer season). The average values of Cr were 123.26 ± 49.81 mg/kg, 104.91 ± 34.80 mg/kg and 106.87 ± 34.46 mg/kg at Gh1, Gh2 and Gh3 respectively. Bhattacharya et al. (2008) found Cr concentrations in the range 0.281-0.391 µg/kg in sediments of the river Ganga at Rishra-Konnagar, West Bengal, India. Pandey et al. (2016) found mean concentrations of Cr 131.8 mg/kg in the sediments of the river Ganga at Allahabad, India.

Cd concentrations were found utmost as 0.56 mg/kg at Gh2 during summer season, whereas, its minimum values were predicted as 0.23 mg/kg at Gh1 during monsoon season. Singh et al.(2017) estimated the average concentration Cd in the sediment of the River Ghaghara below the permissible value set up by USEPA 0.21 ± 0.08 mg/kg at Katerniaghat, 0.23 ± 0.11 mg/kg at Colonelganj, 0.28 ± 0.10 mg/kg at Ayodhya, 0.25 ± 0.10 mg/kg at Dohrighat, and 0.24 ± 0.06 mg/kg at Chhapra.

The maximum observed values of Pb concentrations were 21.34 mg/kg at Gh2 during summer season where as minimum concentrations were recorded as 10.23 mg/kg at Gh3 during monsoon season. Ruby et al. 2016 reported the mean concentration of Pb 23.80 mg/kg in the sediments of Ganga basin in Allahabad, Uttar Pradesh, India.

Mean values of Zn concentrations estimated were 74.12 ± 22.48 mg/kg, 80.55 ± 25.98 mg/kg and 73.34 ± 22.90 mg/kg at Gh1, Gh2 and Gh3 respectively. Goswami and Sanjay (2014) determined Zn concentrations using pulse anodic striping voltametry in the sediments of the Ganga river in the long stretch of Indo Gangetic plain from Rishikesh to Allahabad and reported its concentrations at Haridwar 172.65mg/kg, Narora ghat 413.13mg/kg, Jajmau (Kanpur) 457.12 mg/kg.

Ni concentration in sediments was highest at Gh2 during summer season (36.32 mg/kg) and its concentrations were found lowest at G2 during monsoon season (16.87 mg/kg). Pandey and Singh (2017) estimated Ni concentrations in sediments higher during summer and lowest during winter seasons in the river Ganga at Varanasi, India

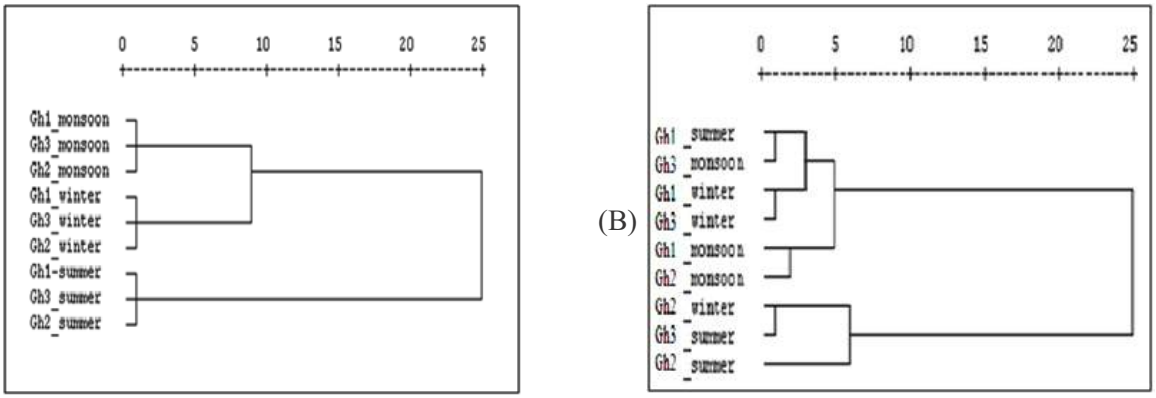


Figure 2. Dendrogram using Ward's method for metal concentrations of the river water (A) and sediments (B) of Ganga at Ghazipur.

Pearson's correlation indicates strong correlation between all of the elements in the river bed sediments (Table 5). Cluster analysis of the heavy metals contamination in sediments indicates the division of groups on the basis of seasonal variations and different sources of contamination (Figure 2.(B)). Two clusters are produced, in the first cluster1 two subgroups with less distance are observed. Two subgroups are comprised of four closer components, i.e., Gh1_summer, Gh3_monsoon , Gh1_winter and Gh3_winter; whereas, another. Second subgroup is composed of Gh1_monsoon, Gh2_monsoon. A second cluster is comprised of three objects in which the two closer objects are Gh2_winter and Gh3_summer whereas the most isolated object is Gh2_summer. This isolated object, thus indicates other source of contamination which influences more during the summer season. Singh et al. (2002) high positive correlation between concentrations of Cr/Ni, Cr/Cu, Cr/Zn, Ni/Zn, Ni/Cu, Cu/Zn, Cu/Cd, Cu/Pb, Fe/Co, Mn/Co, Zn/Cd, Zn/Pb and Cd/Pb in freshly deposited stream sediments from six urban centres of the Ganga Plain

Table 5. Pearson's correlation for the heavy metal concentrations of the river Ganga bed sediments

	Cu	Cd	Cr	Zn	Ni	Pb
Cu	1					
Cd	.989**	1				
Cr	.966**	.987**	1			
Zn	.975**	.959**	.911**	1		
Ni	.966**	.989**	.982**	.939**	1	
Pb	.941**	.944**	.922**	.953**	.957**	1

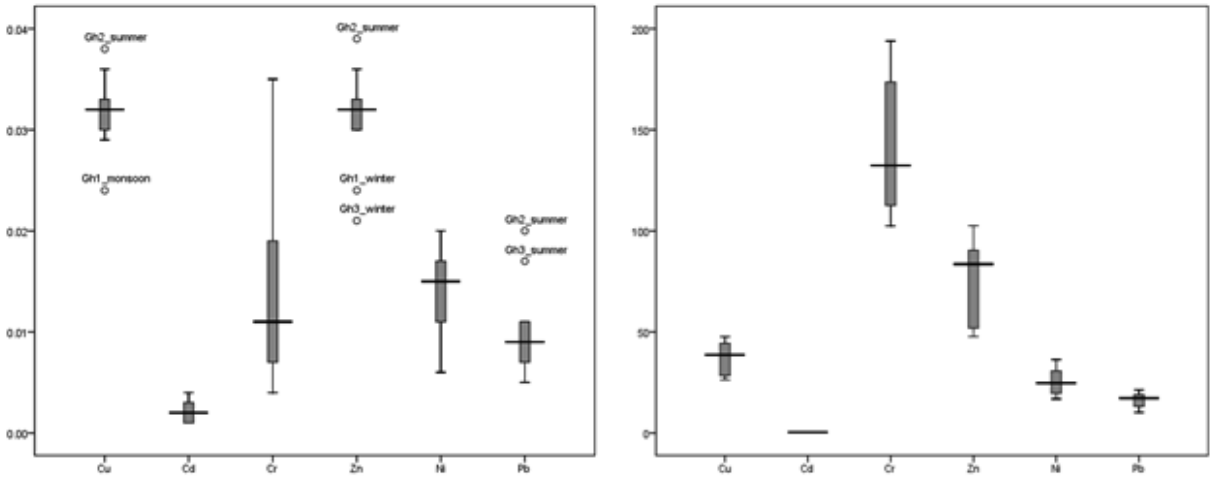
**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The considered values of CF, CD and PLI of metals in sediments are summarized in Table 6. The estimated CF values of the metals positioned in class 2 ($1 \leq CF < 3$) i.e., moderate contamination. Cu, demonstrates CF values in class 1 means low metal contamination. Highest CF for Cu was calculated at Gh2 (0.85). CF values of Cr revealed moderate contamination of Cr in sediments ($1 \leq CF < 3$). CF value for Cr was highest at Gh2 (1.68) followed by Gh3 (1.50) and Gh1 (1.36). CF values of Cd also followed the class 2 and thus revealed moderate metal pollution. The maximum CF value of Cd was analyzed at Gh2 (1.36). Pb contamination factor showed low contamination with values 0.73, 0.89 and 0.77 at Gh1, Gh2 and Gh3 respectively. Calculated CF values of Zn placed in class 1 which indicated low metal effluence in sediments. The highest CF value of Zn was predicted at Gh2 (0.84). CF values evaluated for Ni also cited in class 1 ($CF < 1$) thus clarify low metal contamination (Figure 3. (C)). Contamination degree (CD) of heavy metals in sediments confirmed moderate degree of metal pollution in Ghazipur. The CD is maximum at Gh2 (6.05) which is slightly more than CD value at Gh3 (5.45). Maximum PLI was found at Gh2 which is less than one, it reveals anthropogenic interferences are higher at midstream than that of at the upstream and downstream of the river Ganga at Ghazipur. Vaithiyanathan et al.(1992) calculated Geo-accumulation indices and suggest that Cd, Zn, Cr, Pb, Cu and Ni are enriched in sediments several times over background values in Cauvery river.

Table 6. Contamination factor (CF) of the Ganga river sediment at Ghazipur

Heavy metal	Gh1(CF)	Gh2(CF)	Gh3(CF)
Cu	0.83	0.85	0.79
Cr	1.36	1.68	1.50
Cd	1.23	1.36	1.23
Pb	0.73	0.89	0.77
Zn	0.78	0.84	0.77
Ni	0.34	0.40	0.36
CD	5.30	6.05	5.45
PLI	0.80	0.91	0.82



(C) **(D)**

Figure 3. Box plot for heavy metal concentration of the river Ganga (C) water (mg/l) and (D) bed sediments(mg/kg) at Ghazipur showing variations in distribution of parameters at different study sites.

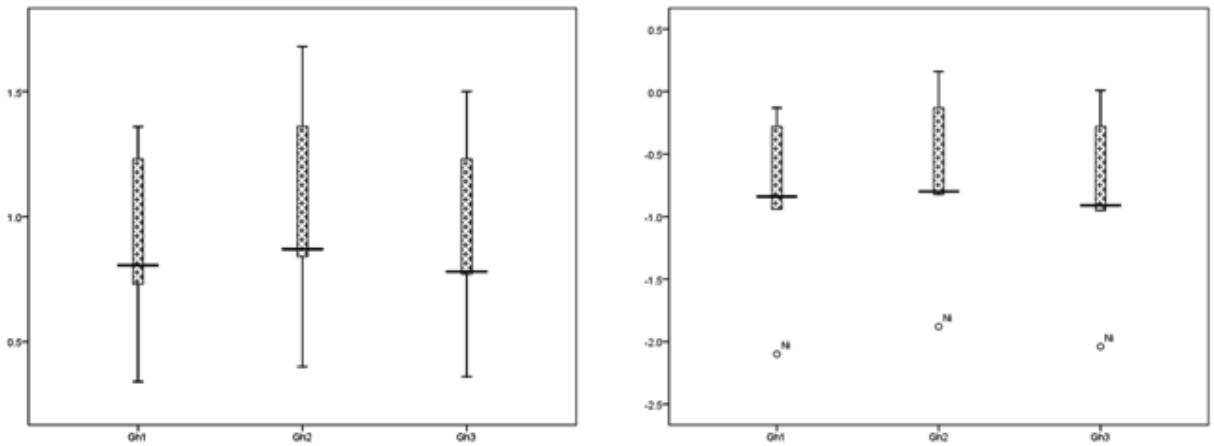
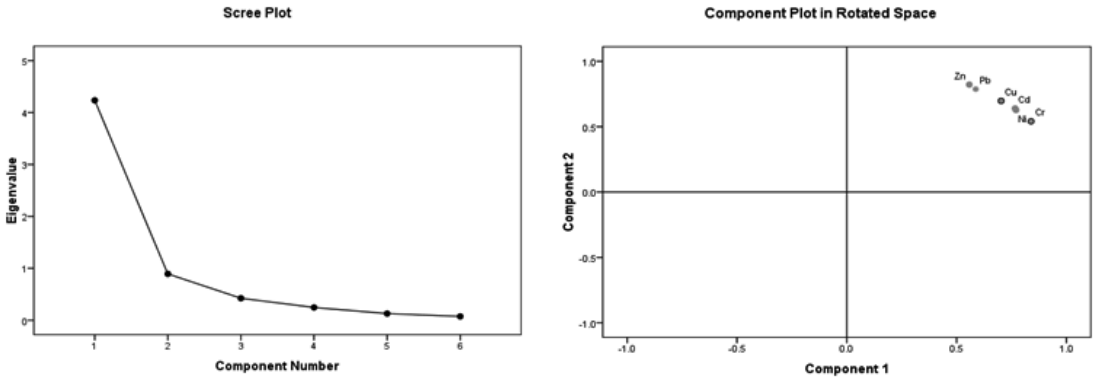


Figure. 4 (E) showing box plot of contamination factor (CF) of heavy metals in sediment of the river Ganga at Ghazipur, (F) showing box plot of Geo accumulation (Igeo) of heavy metals in sediment of the river Ganga, Ghazipur.



(G) **(H)**

Figure 5 (G) showing the scree plot of PCA of heavy metals in the river water and (H) showing the biplot of component in rotated space.

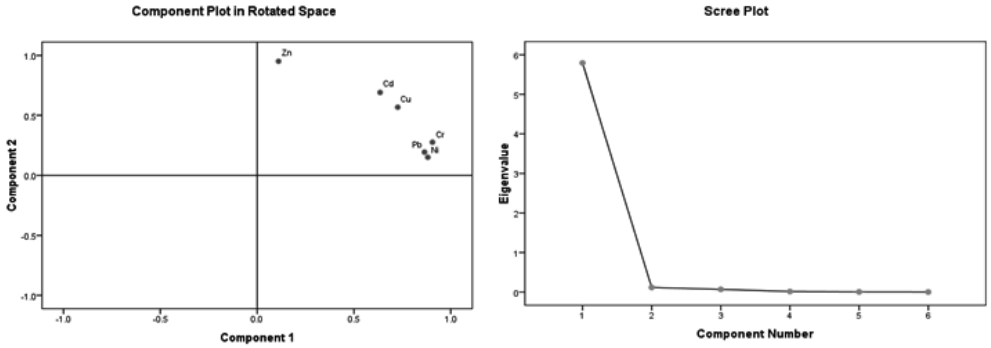
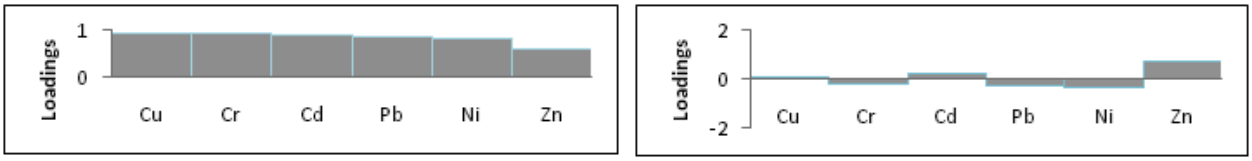
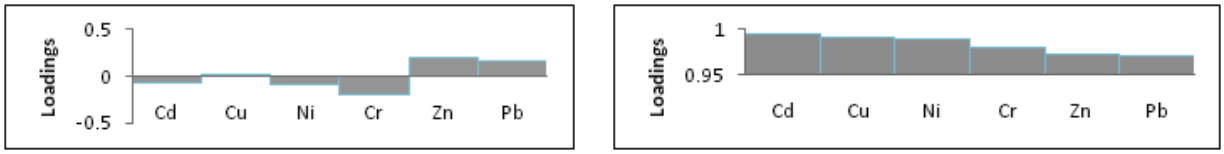


Figure. 6 (H) showing the scree plot of PCA of heavy metals in the river bed sediments and (I) showing the biplot of component in rotated space.



(J) **(K)**

Figure. 7 (J) showing PC1 loadings of heavy metal concentrations in river water data and (K) showing PC2 loadings of heavy metal concentrations in river water data



(O) **(P)**

Figure. 8 (L) showing PC1 loadings of heavy metal concentrations in river bed sediments data and (M)showing PC2 loadings of heavy metal concentrations in river bed sediments data.

A comparative evaluation of heavy metals of the river Ganga sediments with Average shale value (ASV), Toxic response factor (TRV), Indian river system (IRS), and world river system (WRS) is declared in Table 7.

Table. 7 Comparative analysis of heavy metal concentration of Ganga River Sediment (GRS) with Average Shale Values (ASV), Toxic Response Factor (TRV), Indian River System (IRS), and World river system (WRS).

Heavy metals	Present study range in sediments (mg/kg)	USEPA*	ASV'	T_i"	IRS (average)**	WRS°
Cu	26.34 - 47.65	31.6	45	5	28	100
Cr	102.42 - 193.89	43.4	90	2	87	100
Cd	0.23 - 0.56	0.99	0.30	0.30	-	-
Pb	10.23 - 21.34	35.8	20	20	-	-
Zn	47.67 - 102.53	121	95	1	16	350
Ni	16.87 - 36.32	22.7	68	5	37	90

Note:* USEPA (1999), ' Turekian and Wedepohl (1961), " Hakanson (1980), **Subramanian et al. (1987), °Martin and Meybeck (1979)

Potential ecological risk index (RI) (Table 8) confirmed low grade of ecological risk at the three sampling stations. Highest RI values are established at Gh2 (55.98) followed by Gh3 (50.47) and Gh1 (50.10). Most of the Igeo values are noted negative of metal concentrations in sediments except Cr (Fig 5 (H)).

Table 8. Potential ecological risk index (RI) of the Ganga river sediment at Ghazipur

Sites	Cu T_i*CF	Cr T_i*CF	Cd T_i*CF	Pb T_i*CF	Zn T_i*CF	Ni T_i*CF	RI	Grade
Gh1	4.17	2.73	37	3.66	0.78	1.74	50.10	Low
Gh2	4.28	3.37	41	4.45	0.84	2.02	55.98	Low
Gh3	3.98	3.01	37	3.88	0.77	1.81	50.47	Low

I_{geo} values for Cr positioned in class 2 which shows uncontaminated to moderate contamination of this particular metal in freshly deposited sediments (Table 9).

Table 9. Geo-accumulation index (I_{geo}) of the Ganga river sediment at Ghazipur

Sampling sites	Cu	Cr	Cd	Pb	Zn	Ni
Gh1	-0.846	-0.13	-0.28	-1.03	-0.94	-2.10
Gh2	-0.808	0.16	-0.13	-0.75	-0.82	-1.88
Gh3	-0.91	0.009	-0.28	-0.94	-0.95	-2.04
Min	-0.91	-0.13	-0.28	-1.03	-0.94	-2.10
Max	-0.80	0.16	-0.13	-0.75	-0.82	-1.88
I_{geo} value						

Principal component analysis (PCA)

The factor analysis is applied for the reduction of a large number of variables into a few core factors (6). Firstly it involves the Kaiser- Meyer - Olkin (KMO) test in which, the sampling adequacy for factor analysis is checked. The values nearby 1 are considered sufficient and 0.6 is the minimum value preferred. Secondly, Bartlett's test of sphericity confirms that correlation matrix has an identity matrix (Helena et al., 2000). After both tests, eigenvalues are the most important which shows the variances of the factors (Helena et al., 2000; Wunderlin et al., 2001).

The initial values are selected as the numbers of the variables to be used in the factor analysis. In the present study, PCA with VARIMAX rotation is applied on heavy metal concentrations in the river water and also on heavy metal concentrations found in freshly deposited bed sediments. KMO value for heavy metals in river water was found to be 0.795, which indicates a good measure of sampling adequacy. Bartlett's test of sphericity constructed a highly significant value of $p<0.001$, and the approximate of Chi- square is 28.836 with 15 degrees of freedom, which is significant at 0.017 values (Table 10). This shows that correlation matrix was not an identify matrix and significant associations exist between the variables. Hereby, it is confirmed that heavy metals data for the river water is suitable for estimating PCA. On the basis of highest eigenvalues, two components are extracted with 70.57 % of variance and 14.883 % (Table 11) . PC1 is dominant by strong factor loadings (shown in Table 12) for Cu (0.917), Cr (0.913), Cd (0.906) , Pb (0.835), Ni (0.826) and Zn (0.600). The scree plot shows a sharp change in the curvature after factor 2 (Fig 6).

Table 10. KMO and Bartlett's test of factor analysis of heavy metals in the river water data

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.795
Bartlett's Test of Sphericity	Approx. Chi -Square	28.836
	Df	15
	Sig.	.017

Table 11. Total variance explained for heavy metals in the river water data

Total Varia nce Explained									
Com pone nt	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.234	70.570	70.570	4.234	70.570	70.570	3.286	54.769	54.769
2	.893	14.883	85.453	.893	14.883	85.453	1.841	30.684	85.453
3	.424	7.060	92.513						
4	.246	4.102	96.615						
5	.129	2.149	98.765						
6	.074	1.235	100.000						

Extraction Method: Principal Component Analysis.

PCA for studied heavy at metals concentrations in sediments is also executed. KMO value was 0.750 and Bartlett's test of sphericity with approx. Chi square is 100.085 with degree of freedom 15 (Table. 14). Two components were extracted for factor analysis with 96.572 % (PC1)of variance and 1.939 % (PC2) of the variance (Table 15). PC1 has all strong factor loadings Cd (0.995), Cu (0.990), Ni (0.989), Cr (0.979), Zn (0.973) and Pb (0.970) (Table. 16) . The scree plot shows that after factor 2 the total variance accounts for smaller amounts (Figure. 7).

Table 12. Factor loadings of the principal components extracted for heavy metals in the river water data

Component Matrix			Rotated Component Matrix			Communalities		
	1	2		1	2		Initial	Extraction
Cu	.917	.094	Cr	.905	.276	Cu	1.000	.849
Cr	.913	-.248	Ni	.881	.151	Cd	1.000	.881
Cd	.906	.247	Pb	.864	.194	Cr	1.000	.896
Pb	.835	-.297	Cu	.726	.568	Zn	1.000	.917
Ni	.826	-.342	Zn	.110	.951	Ni	1.000	.800
Zn	.600	.746	Cd	.635	.691	Pb	1.000	.784

Table 13. Component Transformation Matrix of heavy metals in the river water data

Component Transformation Matrix

Component	1	2
1	.846	.533
2	-.533	.846

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table 14. KMO and Bartlett's test of factor analysis of heavy metals in the river bed sediment data

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.750
Bartlett's Test of Sphericity	Approx. Chi-Square	100.085
	Df	15
	Sig.	.000

Table 15. Total variance explained for heavy metals in the river bed sediment data

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.794	96.572	96.572	5.794	96.572	96.572	3.034	50.562	50.562
2	.116	1.939	98.511	.116	1.939	98.511	2.877	47.948	98.511
3	.069	1.151	99.662						
4	.014	.237	99.899						
5	.005	.081	99.980						
6	.001	.020	100.000						

Extraction Method: Principal Component Analysis.

Table 16. Factor loadings of the principal components extracted for heavy metals in the river bed sediment

Component Matrix			Rotated Component Matrix			Communalities	
1	2		1	2		Initial	Extraction
Cd	.995	-.076	Cr	.839	.541	Cu	1.000	.980
Cu	.990	.010	Ni	.770	.627	Cd	1.000	.996
Ni	.989	-.088	Cd	.766	.640	Cr	1.000	.996
Cr	.979	-.197	Cu	.703	.698	Zn	1.000	.986
Zn	.973	.200	Zn	.558	.822	Ni	1.000	.987
Pb	.970	.155	Pb	.587	.787	Pb	1.000	.964

Extraction Method: Principal Component Analysis.

Table 17. Component Transformation Matrix of heavy metals in the river bed sediment data

Component Transformation Matrix

Component	1	2
1	.717	.697
2	-.697	.717

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

Table 18. Comparison between the metal concentrations in sediment and river water of different rivers in different countries with that of present study.

River	Concentrations of metals in sediment and river water						References
	Cu	Cd	Cr	Zn	Pb	Ni	
Ganga, India(sediment)	35.85-38.53mg/kg	0.37-0.41mg/kg	123.26-151.77mg/kg	73.34-80.55mg/kg	14.67-17.82mg/kg	23.75-27.54mg/kg	Present study
Ganga, India (water)	0.029-0.035mg/l	0.001-0.003mg/l	0.008-0.021mg/l	0.028-0.036mg/l	0.008-0.011mg/l	0.011-0.015mg/l	Present study
Ganga, India (sediment)	29.8 µg/g	1.7 µg/g	69.9 µg/g	67.8 µg/g	26.7 µg/g	26.7 µg/g	Pandey and Singh, (2015)
Cauvery, India (sediment)	11.2 µg/g	1.3 µg/g	38.9 µg/g	93.1 µg/g	4.3 µg/g	27.7 µg/g	Raju et al. (2012)
Tapti, India (sediment)	0.5 µg/g	-	-	6.1 µg/g	-	-	Marathe et al. (2011)
Yangtze, China (sediment)	60.03 µg/g	1.0 µg/g	108.0 µg/g	230.4 µg/g	49.2 µg/g	41.9 µg/g	Wang et al. (2011)
Buriganga, Bangladesh (sediment)	184.4 µg/g	0.8 µg/g	101.2 µg/g	502.3 µg/g	79.8 µg/g	-	Saha and Hossain (2010)
Euphrates, Iraq (sediment)	18.9 µg/g	1.9 µg/g	58.4 µg/g	48.0 µg/g	22.6 µg/g	67.1 µg/g	Salah et al. (2012)
Ganga, India (water)	ND-30 µg/l	ND-10 µg/l	ND-18 µg/l	26-122 µg/l	18-86 µg/l	-	Gupta et al.(2009)

River	Concentrations of metals in sediment and river water						References
	Cu	Cd	Cr	Zn	Pb	Ni	
Kali, India (water)	-	0.06-0.08 mg/l	0.06-0.09 mg/l	24.71-29.71mg/l	0.13-0.19 mg/l	-	Mishra et al. (2015)
Yamuna, India (sediment)	40-439mg/kg	0.5-11.8 mg/kg	163-817 mg/kg	110-1472mg/kg	22-253mg/kg	40-438mg/kg	Kumar et al. (2013)
Gomati, India(water)	0.0013-0.0043mg/l	0.0001-0.00005 mg/l	0.0015-0.0688mg/l	0.0144-0.0298mg/l	0.0158-0.0276mg/l	0.0066-0.011mg/l	Singh et al. (2005)
Ghaghra, India(water)	0.010-0.047mg/l	0.001-0.057mg/l	ND-0.010mg/l	0.002-0.042mg/l	0.001-0.029mg/l	0.002-0.032mg/l	Singh et al. (2016)
Damodar, India(water)	0.00065-0.01249 mg/l	ND-0.0013mg/l	-	0.00213-0.02632 mg/l	0.0005-0.00651 mg/l	-	Bhattacharyay et al. (2005)
Karnaphuli, Bangladesh(sediment)	-	0.63-3.56mg/kg	11.56-35.48mg/kg	-	21.98-73.42mg/kg	-	Ali et al. (2016)
Yellow river, China (sediment)	-	ND	41-128mg/kg	-	26-78mg/kg	-	Liu et al.(2009)

CONCLUSION

In the present study, heavy metal concentrations were found within the permissible limits of WHO water quality standards. Cd and Cr concentrations were found close to acceptable limits for potable water. Heavy metal concentration of Cu and Zn in sediments was estimated higher than USPHS standards during summer seasons at Gh2. Comparison between the metal concentrations in sediment and river water of different rivers in different countries with that of present study is shown in Table 18. Pearson's correlation matrix for heavy metal concentrations in the river water revealed various interrelationship between metal. Cluster analysis elucidated similarity in different study sites in different seasons. Maximum PLI was found at Gh2 which is less than one, it reveals anthropogenic interferences are higher at midstream than that of at the upstream and downstream of the river Ganga at Ghazipur. RI confirmed low grade of ecological risk at the three sampling stations. On the basis of highest eigenvalues, two components are extracted in both river water and bed sediments, where, PC1 is dominant by strong factor loadings for both river water and sediments. Regular monitoring programs for the heavy metals is suggested to protect these water bodies and also to decrease environmental risk. The current study data specify the moderate pollution level along the river Ganga at Ghazipur. However, the mounting population load allied with urbanization to fulfill the economical growth in the basin may grounds irrevocable ecological damage in the long term. It also suggests a need of reliable and internationally documented data driven strategy to assess the creation of international standards for the assessment of contamination levels.

ACKNOWLEDGEMENT

Authors are appreciative to the

University Grant Commission for providing financial support for the research work and Department of Botany, University of Allahabad for the appropriate laboratory facilities and assistance for the completion of research work.

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Journal of Natural Resource and Development 13 (1) 65-68, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

TRIACTINOMYXON (ACTENOSPOREAN STAGE, MYXOZOA) FROM FRESH WATERS OF MEERUT REGION

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Received : 17.12.2017 Accepted : 19.01.2018

ABSTRACT

Although we know about Myxosporean of fishes but practically nothing has been done on actinosporeans infecting oligochaetes from India. The Myxosporean are one of important group of micro organisms parasitizing marine & freshwater fishes, causing serious diseases including kidney disease & whirling disease in Salmonid. It has been established that actinosporean are infective stages of Myxosporean (Molnar et al., 1999). Water samples were collected from the fish culture ponds of Meerut region together with mud and roots of aquatic vegetation together with oligochaetes (Tubifex tubifex). Clear water was taken out & filtered through 10 pore size filter paper for examination of Triactinomyxon. The photographs of Triactinomyxon were taken with the help of Motic research microscope at high magnification . Digitized still images of the actinospore were taken with the help of Motic image programme & drawings of actinospore were made. The measurements were taken as described by Lom et al., (1997). The characterization and identification of the Triactinomyxon recorded with the help of classical work of Yokoyama et al., (1993 and 1995). The upper part of spore, the apex containing polar capsule, is cup-shaped structure, slightly narrow anteriorly. Secondary cells (pansporocyst), spore body, style and caudal process are present in this stage of actinospore. Hence the present investigation has been started to isolate Triactinomyxon stage from Meerut region.

Key words : *Myxosporean, triactinomyxon, fresh water.*

INTRODUCTION

Myxosporidea are unique group of parasitic protozoans. More than 1200 species of Myxosporidea parasitizing exclusively fishes both marine & fresh water, have been recorded(Shulman, 1988).

Myxosporidea are a parasitic protozoan, pathogenic agent causing serious

diseases including PDK kidney disease and whirling disease in Salmonid and heavy infection can cause high mortalities of fish in pond cultures and natural reservoirs throughout the world. The life cycle of myxosporideans, specially the cycle outside the fish host and the mode of transmission have remained unknown. Until now, all infection trials with fresh spores, co-existence with infected fishes and feeding with the infected tissue have failed, Fryer and Sanders 1970; Yokoyama et al., 1991)

Recently,a series of studies have proved that Myxobolus cerebralis, causative agent of whirling disease had a two host life cycle , involving fish and an invertebrate and alternate two different sporogenic stages in the life cycle (Markiwand and Wolf 1983;Wolf and Markiw,1984; Markiw,1986;Wolf et al.,1986 And Markiw,1989 and 1989).Molnar et al.,(1999) has established experimentally that actinosporean are infective stages of myxosposporean on the basis of their molecular biological identification.

But the survey of literature reveals that practically no attention has been paid to study this life cycle stage of myxosprean protozoan parasite of India Thus present investigation is started to study the fresh water actinosprean and it is first report from india particularly from Meerut region.

MATERIALS AND METHODS

Water samples were collected from three different ponds situated near Meerut together with mud & oligochaetes. The samples were kept in separate plastic containers filled with water and allowed to settle down for a day. From each of these containers, clear water was taken out and filtered through 10µm pore size filter paper for examination of actinospores. The filtering material was shifted on a glass slide and examined for the presence of actinospores at various magnifications under a microscope.

The photographs of actinospores were taken with the help of Motic research microscope at high magnification . Digitized still images of the actinospores were taken with the help of Motic image programme & drawings of actinospores were made. The measurements were taken as described by Lom et al., (1997). The characteristic dimensions of actinospores like polar capsule, spore body, style caudal process and whole body length were measured with the help of Motic image analyzing system. Measurements were confirmed with the help of stage micrometer and occulometer. The characterization and identification of the actinospores recorded with the help of classical work of Yokoyama et al., (1993 and 1995). The measurements of actinospores type was taken according to the guidance given by Lom et al., (1997)

RESULTS AND DISCUSSION

Triactinomyxon actinospores types was isolated from the water samples collected from ponds of the Meerut region.

Triactinomyxon sp. (Fig. 1 and Photomicrograph 1):

The upper part of spore, the apex containing polar capsule, is cup-shaped structure, slightly narrow anteriorly, measuring 11.8x5.9 µm. The number of secondary cells (pansporocyst) constituting 2 to 4 cells. Total length of spore body measuring 11.8 µm. The length of style 102 µm, whereas width of style is uniform, measuring 9.4 µm and length of caudal process is 128 x 10.6 µm (irrespective of curvature). The largest span between the tips of caudal processes is approximately 236.6 µm.

Photomicrograph of Triactinomyxon sp

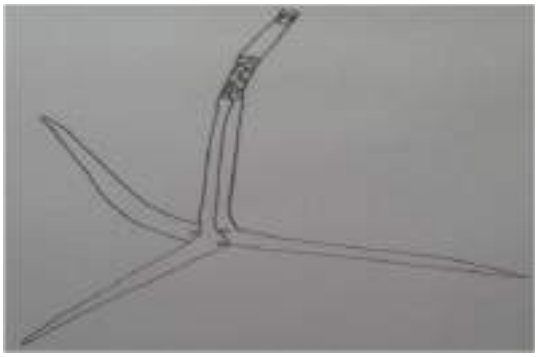

Fig 1. Line drawing of Triactinomyxon sp

Actinosporean infections of oligochaetes and their presence in natural waters and fish ponds have been studied by many workers like Ikeda, 1912, Mackinnon & Adam, 1924, Janiszewska, 1955 and 1957. Subsequently in recent years, actinosporean infection of oligochaetes have been studied successfully by numerous workers throughout the globe by workers like Markiw(1986); El-Matbouli and Hoffman(1989); Szekely (1989); Yokoyama et al., (1991); El-Matbouli and Hoffman(1993); Kent et al., (1993); El-Matbouli et al., (1995); Pallos (1995); Uspenskaya (1995); Yokoyama et al., (1995) and Trouillier et al., (1996).

From Indian subcontinent, practically nothing has been done on actinosporeans infecting oligochaetes although, we know about myxosporeans of fishes. In the present investigation presence of Triactinomyxon sp. indicated the possibility of whirling disease in fresh water fishes of India. The investigator was not successful to identify the actinosporeans upto species level due to some technical constrains.

But this preliminary survey of actinosporeans from Indian freshwaters shows that this subject has vast potential in India.

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Journal of Natural Resource and Development 13 (1) 69-74, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

ECONOMICS OF MARKETING OF MANGO IN DISTRICT LUCKNOW (UTTAR PRADESH)

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Received : 19.04.2018 Accepted : 09.05.2018

ABSTRACT

Mango (Mangifera indica L.) belongs to family Anacardiaceae is the most important commercially grown fruit crop of the country. It is called the king of fruits. India has the richest collection of mango cultivars. The main objective of the study was to critically appraise the whole marketing system of mongo crop in Malihabad block of Lucknow District. The two decisive facts of mango systems structure and channels of marketing and prices spread and marginal of profit of mango were studied in detail. For the present study the five stages stage stratified sampling design was adopted. In the first stage district was selected purposively. The block and villages were selected in the second and third stage according to there areas under cultivation. In the forth stage selection of growers was done on the basis of area under mango cultivation. Malihabad block was purposively selected for the study because it has maximum area Mango cultivation. Further for the study of price spread in the marketing of mango in Dubagga Mandi in Lucknow district was purposively because this is the main and nearest market of mango. The total area under mango was found to be 97.32 ha. The total production was found 461.40 Qtls/ ha. The marketable surplus was found to be 47.90.Qtls/ha in small size group, 126 Qtls/ha in medium and 273.04 Qtls/ha in large size group. As the size of holding increased the marketable surplus also increased. The marketing efficiency was worked out in both channels and was found that the marketing efficiency in channels I was 0.60% and 0.52% in channel II.

Key words : *Marketing cost, marketing margin, price spread, post harvest, losses.*

INTRODUCTION

India ranks first among word's mango producing countries accounting for about 50% of the world's mango production. Other major mango production countries include China, Thailand, Mexico, Pakistan, Philippines, Indonesia, Brazil, Nigeria and Egypt. India' share is around 52% of world production.

Mango is a perennial branched evergreen tree and can be up to 40 meters tall. Propagation can be by seeds or clonally propagated grafted trees. Trees flower after 5-7 years, but clonally

propagated trees are smaller and can flower after 3-4 years. Night temperature of 10-12˚C and dry weather condition promote flower initiation and flowers are borne on branched panicles. Panicles typically consist of hermaphrodite and male flowers and Pollination type depends on cultivars.

The nutritional importance of mango:

A 100g Mango contain

Water	81.0g
Energy	74 k cal
Protein	0.6 g
Lipids	0.4 g
Carbohydrates	16.9 g
Calcium	14 mg
Phosphorus	16 mg
Iron	1.3 mg
Carotene	2743 micro g
Thiamin	80 micro g
Riboflavin	90 micro g
Niacin	0.9 mg
Vitamin C	16 mg

Marketing of the produce is mainly controlled by intermediaries like wholesaler and commission agents. Road transport by trucks is the most popular mode of transport due to easy approach to the market. In the appraisal of an existing marketing operation, the accurate evaluation of losses occurring is a problem, it may be suspected that losses are too great but there may be no figures to support this view because records do not exit, records if available do not cover a long enough period of time, the figures available are only estimates made by several observers records may not truly represent a continuing situation, for example, losses may have been calculated only when unusually high or low, loss figures may deliberately over or understated for commercial or other reasons in order to gain benefits or to embarrassment. Consequently if accurate records of losses at various stage of the marketing operation have not been kept over a period of time, a reliable assessment of the potential cost-effectiveness of ways to improve handling methods is virtually impossible and the marketing position of the grower is difficult to strengthen.

Per-harvest production practices may seriously affect post-harvest returns in quality and quantity and result in the rejection or down grading of produce at the time of sale.

MATERIALS AND METHODS

Selection of District: Lucknow district was purposively selected. As Lucknow district is famous for the production of best quality of mango on the commercial scale.

Selection of Block: Malihabad block was selected purposively having maximum area under mango cultivation comparatively to other block.

Selection of villages: Five villages were selected randomly.

Selection of Mango growers: sample of 20% mango growers was selected randomly from each size group.

Size group	Area	Number of growers
Small size group	Below 1 ha	27
Marginal size group	1-2 ha	20
Large size group	2 and above ha	13

Selection of Market : Dubagga Mandi in the Lucknow district selected purposively.

Marketing Channels:

(1) Producers-contractors-wholesalers-retailers-consumers.

(2) Producers-wholesalers-retailers-consumers.

Study Year :

Study year 2015-16

RESULTS AND DISCUSSION

Keeping in view in main objectives of the study the findings of the investigation have been presented under the following:

Sample structure of the Mango Producer:

Before describing the marketing system, market structure, marketing channels and price spread for mango, it is pertinent to examine sample structure of the producers since productivity of return assumes special importance for a commercial crop like mango for the present study a 20% sample was taken for all the small, medium and large size group of producers. A total of 60% producers were selected randomly from the selected villages. Stratified sampling procedure was used.

Marketable surplus in mango growers (Qtls):

S. No.	No of farmers	Size group	Total Area (ha)	Total yield (Qtls/ha)	Marketable surplus
1	27	Small	23.45	48.78	47.90
2	20	Medium	30.24	128.38	126.65
3	13	Large	43.63	284.24	273.04
Total	**60**	**Sample average**	**30.08**	**126.32**	**84.93**

The table indicates that average area and yield under Mango very directly with the size of holding. According to the above table in small, medium and large size groups the yield of mango were 48.78 Qtls/ha. 128.38 Qtls/ha and 126.32 Qtls/ha respectively. The marketable surplus was calculated as 84.93 Qtls.

The system structure and channels of Mango marketing:

In the context of modernizing Socio-economic infrastructure of farming community of agricultural produce has a vital importance in marking farm economy sound and in boosting up the productivity. Marketing is fundamental business philosophy, an attitude or course of business action by which products are physically matched with markets and through which transfers of ownership are affected.

The price spread has been analyzed in terms of (1) rupee per quintal (2) As presence of producer's share in consumer's rupee. The services rendered by various functionaries were as under.

Growers—Contractors—Wholesaler—Retailer - Consumer:

The price spread, marketing cost and Margins:

The analysis of price spread, marketing cost and margins is an important method of examining the pricing efficiency of the market. The study upon the shares in agricultural marketing is an important aspect since, it reflects upon the shares of the producers and different functionaries as well as marketing cost, out of the price paid by the consumers. It is the actual difference between the price paid by the consumers and the prices received by the grower.

Chanel-I Producer - Wholesaler - Retailer - Consumer.

S.No.	Particulars	Amount Rs/Qtls	% of consumer's rupee
A	**Producer**		
	(i) Price received by producer	760.00	49.71
	(ii) Charges paid by producer		
	(a) Transportation	37.17	2.38
	(b) Loading and unloading	4.0	0.25
	(c) Weigh man	5.0	0.32
	(d) Post harvest losses	44.65	2.86
	(e) Mandi Samiti @3 %	22.80	1.44
	(f) Cost of Packaging	60.0	3.84

S.No.	Particulars	Amount Rs/Qtls	% of consumer's rupee
	(iii) Total charges paid by producer	173.62	11.12
	(iv) Net amount Received by producer	586.38	37.60
B	**Wholesaler**		
	(i) Wholesaler's sale price	1240.00	79.48
	(ii) Charge paid by Wholesaler		
	(a) Loading and unloading	4.00	0.25
	(b) Weigh man	5.00	0.32
	(c) Cost of packaging	80.00	5.12
	(d) Mandi Samiti@%	37.20	2.38
	(g) Post harvest losses	127.20	8.15
	(iii) Charge paid by Wholesaler	253.40	16.24
	(iv) Net margin received	226.60	14.52
C	**Retailer**		
	(i) Retailer sale price	1560.00	100.00
	(ii) Charges paid by retailer		
	(a) Transportation	48.14	3.08
	(b) Loading and unloading	4.00	0.25
	(c) Post harvest losses	74.28	4.76
	(iii) Total charges paid by Retailer	126.42	8.10
	(iv) Net amount received by producer	193.58	12.40
	(v) Purchase price of consumer	1560.00	100.00

Chanel - II Producer - Pre-harvest Contractor - Wholesaler - Retailer - Consumer

S.No	Particulars	Amount Rs/Qtls	% of consumer's rupee
A	**Producer**		
	(i) Price received by producer	640	34.40
	(ii) Charges paid by producer		
	(a) Transportation		
	(b) Loading and unloading		
	(c) Weigh man		
	(d) Post harvest losses		
	(e) Mandi Samiti @ 3.0%		
	(iii) Total charges paid by producer	00.00	00.00
	(iv) Net amount Received by producer	640.00	34.40
B	**Contractor**		
	(i) Contractor sale price	1080.00	58.06
	(ii) Charges paid by contractor		
	(a) Transportation	70.80	3.80
	(b) Loading and unloading	4.00	0.21
	(c) Weigh man	5.0	0.26
	(d) Post harvest losses	77.42	4.16
	(e) Mandi Samiti @ 3.0%	34.50	1.85
	(f) Post harvest losses	96.05	5.20

S.No	Particulars	Amount Rs/Qtls	% of consumer's rupee
	(iii) Total charges paid by contractor	288.59	15.51
	(iv) Net margin received by contractor	151.38	8.15
C	**Wholesaler**		
	(i) Wholesaler's sale price	1540.00	82.79
	(ii) Charge paid by Wholesaler		
	(a) Loading and unloading	4.00	0.21
	(b) Weigh man	5.00	0.26
	(c) Cost of packaging	80.00	4.32
	(d) Mandi Samiti@%	46.20	2.48
	(e) Post harvest losses	118.20	6.35
	(iii) Total charge paid by Wholesaler	253.82	13.64
	(iv) Net margin received by wholesaler	206.18	11.08
D	**Retailer**		
	(i) Retailer sale price	1860.00	100.00
	(ii) Charges paid by retailer		
	(a) Transportation	80.57	4.33
	(b) Loading and unloading	4.00	0.21
	(c) Post harvest losses	105.23	5.65
	(iii) Total charges paid by Retailer	189.80	10.20
	(iv) Net amount Received by producer	130.20	7.00

CONCLUSION

The study upon the shares in agricultural marketing is an important aspect since, it reflects upon the shares of the producers and different functionaries as well as marketing cost, out of the price paid by the consumers. It is the actual difference between the price paid by the consumers and the prices received by the grower. Post harvest losses at various levels of intermediaries occur, due to lack of sufficient storage facilities. Lack of proper assistance from the government agencies has been one of the major causes for the inefficiency marketing. The study has undoubtedly pointed out the exploitation of middlemen, who take greater share in the consumer's rupee. The study has also pointed out the need for proper support to the mango growers and solving their constraints regarding loan, marketing, storage and input supply facility. Also, the establishment of processing industries, creation of mango marketing board and the effective implementation of guidelines of the co-operative marketing societies, will help in solving the problems of the marketing.

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Journal of Natural Resource and Development 13 (1) 75-80, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

STUDIES ON SEED BORNE FUNGI IN PUMPKIN AND MUSKMELON CROPS GROWN IN KANPUR UTTAR PRADESH

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Received : 11.04.2018 Accepted : 15.05.2018

ABSTRACT

Pumpkin and Musk-melon is belonging to the family Cucurbitaceae. By using Blotter paper methods and agar Plate technique, the seed borne fungi of Pumpkin & Muskmelonwas studied. A total number of 13 fungal genera & 20 species of fungi were isolated and been recorded from seed of pumpkin& Muskmelon. The agar plate technique & blotter paper method was found to be most suitable technique for detection of fungi in pumpkin& Muskmelon crops. There was the detection ofAspergillus flavus, Aspergillus niger,Aspergillus fumigatus, Alternaria alternate,Botrytis cinerea, Curvularia lunata, Drechslera demotidea, Didymella bryoniae, Fusarium oxysporum, Fusarium semitectum, Fusarium solani, Fusarium equisetiFusarium spp, Aureobasidium pullulans, Gleosporium sp., Rhizopus stolonifers,Macrophomina phaseolina & Penicillium purpurogenum,Penicillium citrinum,Phoma spp.done by these two methods.

Key words : *Cucurbita moschata, cucumis melo, isolation & identification, seed borne, fungi.*

INTRODUCTION

Cucurbitaceae is an economically important family of vegetable and fruit crop for the farmers. It is mainly distributed in tropical and subtropical regions although a few of them are grown in temperate regions also (Jeffrey, 1990).This family has been divided into five sub-families comprising Cyclanthereae, Cucurbitaceae, Fevilleae, Melothrieae & Sicyoideae (Whitaker and Davis, 1962). The cucurbits form a distinct group of species. All cucurbits are botanically 'pepo' and belong to

the family cucurbitaceae. It is the largest group of summer season vegetables. Pumpkin is variously called as Kashiphal and Seetaphal or Gumbala or Red gourd etc. Musk-melon is mostly andromonoecious in nature The ripened musk melon fruits have nutty aroma. Botanically Muskmelon is called Cucumis melo. Cucumis melo is a large polymorphic taxon. Pumpkin was introduced to India from South America by foreign navigations and emissaries. The genus Cucurbitais indigenous to the America. Botanically Pumpkin is called Cucurbita moschata. There are five cultivated species of Cucurbita-

(a) Cucurbitamoschata (Pumpkin or field pumpkin),
(b) Cucurbita pepo (Summer squash)
(c) Cucurbitamaxima (Winter squash)
(d) Cucurbitamixta (Winter squash)
(e) Cucurbita ficifolia (Malabar gourd)

The seeds are rich source of oil and protein used in the preparation of pasta and animal feed (Nerson, 2007). The average nutritive value of pumpkin is 2.68. Edible portion of pumpkin contains 1.4% protein. The flower of Pumpkin are more nutritive than fruits. A wide range of pathogens affect the productivity of Cucurbita moschata (pumpkin).The pathogen may cause seed abortion and rot, necrosis, reduction or elimination of germination capacity as well as seedling damage at later stages of plant growth resulting in development of the disease as systemic or local infection (Khanzada et al., 2002).

Pathogen free healthy seeds are essential for desired plant populations and a good harvest. Of the 16% annual crop losses due to plant diseases, at least 10% loss occurs due to seed-borne diseases (Fakir, 1983).The moisture content of the seed, prevailing temperature, storage period & degree of seed invasion influence the development of seed borne fungi (Anjorin and Mohammed, 2009).Cucurbita spp.are especially susceptible to black rot, which directly reduces both pre and post-harvest yields (Keinath et al., 1995) and(Zitter & Kyle, 1992).Seed-borne diseases have been found to affect the growth and productivity of crop plants (Kubiak & Korbas, 1999).The present study focused on isolation & identification of seed borne fungi of Pumpkin using Agar plate technique &Blotter paper Method.

MATERIALS AND METHODS

This research study was carried out between 10 March 2017 to 10 August 2017 in the Bhargva Agricultural Botany laboratories of the Department of Botany, University of Allahabad, Allahabad, Uttar Pradesh, India.

Study Area :

Kanpur district is located between 26°27'04.81'' N latitudes and 80°20'01.05''E longitudes. Kanpur is a large industrial city on the banks of the Ganges River, in the north Indian state of Uttar Pradesh.

Survey & Collection of Pumpkin vegetables :

Infected Pumpkin (Cucurbita moschata)& Muskmelon (Cucumis melo)seed samples were collected from Kanpur Arban areas in Uttar-Pradesh). The collected samples were put into sterile polythene bags and stored at 4oC until further analysis.

Isolation of Pumpkin Seed borne fungi :

Seed borne fungi were isolated from Cucurbita moschata&Cucumismelo seeds using the Agar Plate technique &Blotter paper methods. During the present investigation following methods were used for seed testing and identification of fungal diseases in Pumpkin crop.

Agar Plate (Potato Dextrose)technique :

The Pumpkin and Muskmelon seeds were disinfected as mentioned before and then mounted on PDA medium (5 seeds per dish). The dishes were incubated at 18°C and 25°C

and examined periodically. At the end of the incubation period, fungi growing out from seeds on the medium are examined and identified. Identification is based on colony characters and morphology of sporulating structures under a compound microscope.

Blotter paper methods

200 Muskmelon & Pumpkin seeds were picked up at random from each sample, surface sterilized by dipping in 3% sodium hypochlorite for three minutes, and then rinsed thoroughly in distilled water. The seeds were left to dry in the laminar flow hood, then mounted on three layers of sterilized wet filter papers in glass Petri dishes (9 cm in diameter) to provide enough moisture during the period of the test. Five seeds were placed in each dish contained blotter and then incubated for 7 days at 18oC and 25oC under fluorescent light (light / darkness rotations of 12/12 hrs), as described by (Neergaard, 1979).

Tested pumpkin &Muskmelon seeds were washed several times in distilled water, immersed in 3 % Naclo solution for three minutes, then washed thoroughly in sterilized water. The disinfected pumpkin seeds were, then dissected aseptically to various parts i.e. inner tissues& seed coatthe various seed parts & also the whole seed were mounted directly on Potato Dextrose Agar medium in the petri dishes (Singh et al., 1973). The dishes were incubated for Seven days under twelve hours fluorescent/twelve hours darkness cycle at 18 o C- 25 o C and examined periodically. The growing fungi were kept for their identification.

Identification of fungi :

The colonies growing on PDA Plates with different morphology were counted separately. A portion of the growing edge of the colony was picked up with of a paw of needles and mounted on a clean slide with lacto phenol cotton blue stain. The slide was gently heated in a sprit lamp so as to facilitate the staining and remove air bubbles, if any. The excess stain was removed with the help of tissue paper and then the cover slip was with transparent nail polish. The slide was observed under a compound microscope. The pure cultures of isolated fungal strains were maintained in PDA slants with streptomycin at 28°C during the study (K.R. Aneja 2004).

Colony colour and morphology were noted besides hyphal structure, spore size, shapes and spores bearing structures. They were compared with the standard works of (Raper and Thom 1949; Van Arx 1974; Ainsworth et al., 1973). In order to purify the isolated fungi, single spore technique was used to purify the spore forming fungi and hyphal tip technique was used for non-spore forming fungi (Hansen, 1926) among others for identification of the species.

Pathogenicity Test :

Some of isolated fungi were used to confirm their pathogenicity test in their respective hosts. Some fresh healthy samples were brought in to the laboratory and surface sterilized with 0.1% HgCl2. For inoculations cork borers of (2mm) diameter were used. They were sterilized by placing in spirit lamp flame, dipping in alcohol and shaking off the excess alcohol by flaming (Granger & Horne, 1924). The inoculated samples and their respective controls were kept under sterile conditions at room temperature under bell jars.

The artificially inoculated samples were examined daily and the extent of damage was recorded. The pathogens were re-isolated and disease symptoms were clearly evident, the culture and symptoms signs were compared with original.

(Table-1) Seed borne fungal genera & fungal species recovered from Pumpkin and Musk-melon crops grown in Kanpur district Uttar Pradesh.

S.N.	*Fungal species*	*Cucumis melo*	*Cucurbita moschata*
1.	*Aspergillus flavus*	+	+
2	*Aspergillus niger*	+	+
3	*Aspergillus fumigatus*	+	_
4	*Alternaria alternate*	+	+
5	*Aureobasidium pullulans*	_	+
6	*Botrytis cinerea*	_	+
7.	*Curvularia lunata*	+	+
8.	*Drechslera demotidea*	_	+
9.	*Didymella bryoniae*	_	+
10.	*Fusarium oxysporum*	+	+
11.	*Fusarium semitectum*	_	+
12.	*Fusarium solani*	+	+
13.	*Fusarium equiseti*	+	_
14.	*Fusarium spp*	+	+
15.	*Gleosporium sp*	+	_
16.	*Macrophomina phaseolina*	_	+
17.	*Penicillium purpurogenum*	_	+
18.	*Penicillium citrinum*	+	_
19.	*Phoma spp.*	+	+
20.	*Rhizopus stolonifers*	+	_

RESULTS AND DISCUSSION

After collection of infected pumpkin seeds, the isolation of fungi was done in Bhargava Agriculture Laboratory; Department of Botany University of Allahabad. The finding of laboratory work hasbeen presented in Table (1). A total number of twenty species of seed borne fungi were recovered from pumpkin & muskmelon crops. The results were obtained, out of twenty species. Fiveof Fusariumwas most incidence species. Three species of Aspergillus and two species of Pencilliumwere recovered from Pumpkin and Musk-melon seeds (table 1). There were ten other fungal species namely; Alternaria alternate, Aureobasidiumpullulans, Botrytis cinerea, Curvularialunata, Drechsleradmotidea, Didymellabryoniae, Gleosporiumsp, Macrophominaphaseolina, Phoma spp., Rhizopusstolonifershas been also recovered from pumpkin and musk-melon seeds. It was noticed that Aspergillusflavus, Aspergillusniger & Alternaria alternateinfects pumpkin and muskmelon seeds. Aspergillusfumigatusinfects only muskmelon seed but it showed negative response on Pumpkin seed. Aureobasidiumpullulans, Botrytis cinerea, Drechsleradmotidea,

Didymellabryoniae&Fusariumsemitectuminfects pumpkin seed but it showed negative response on cucumismelo seed. Curvularialunata, Fusariumoxysporum, Fusariumsolani, Fusariumspp&Phoma spp. infects pumpkin and watermelon seeds. This type similar study has been also done by (Bajpai et al.,2012).

Fusariumequiseti, Gleosporiumsp, Penicilliumcitrinum and Rhizopusstolonifers infects cucumismeloseed but it showed negative response on pumpkin seed (Table.1). Macrophominaphaseolina and Penicilliumpurpurogenuminfects only pumpkin seed but it showed negativeresponse oncucumismeloseed.

CONCLUSION

The total number of 13 fungal genera and 20 species of seed borne fungi were recovered from Cucumismelo and Cucurbitamoschata crop. The study resulted highest fungal genera and species were recorded in pumpkin crops. Minimum fungal genera & species were recorded in Cucumismelo crop.

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Journal of Natural Resource and Development 13 (1) 81-87, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

EFFECT OF CROPPING PATTERN ON GROWTH, YIELD ATTRIBUTES AND SYSTEM PRODUCTIVITY OF CITRONELLA (CITRONELLA WINTERIANUS) INTERCROPPING WITH MAIZE IN CENTRAL U. P.

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Received : 12.01.2018 Accepted : 17.02.2018

ABSTRACT

A field experiment was conducted during Kharif season, 2011-12 at students Instructional Farm (SIF), Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during 2011-12 to study the Effect of cropping pattern on growth, yield attributes and system productivity of citronella (Citronella winterianus L.) intercropping with Maize in Central U.P. The experiment was laid out in Randomized Block Design with different combination. Cultivation of citronella sole crop was superior over sole Maize as well as their intercropping system adopting in different row pattern. There was significant superiority in growth, yield attributes and yield of sole cropping as compared to their intercropping. On an average significantly higher herbage yield of (186.38 q/ha) was recorded in citronella sole cropping followed by 2:1 row ratio of citronella + Maize crop. However, the citronella sole cropping gave significantly highest citronella equivalent oil yield and net returns than other cropping systems. The higher B: C ratio was recorded under citronella sole (10.77) higher, intercropping system citronella: Maize 2:1 row ratio (4.78) than other cropping systems. The higher LER values in citronella: Maize intercropping 1.02, clearly indicate advantage over their sole stand. Citronella sole recorded the highest crop profitability.

Key words: *Citronella, cropping system, land equivalent ratio, maize and system productivity.*

INTRODUCTION

Citronella (Citronella winterianus L.) oil is one of the major essential oils. It has a rose like odour and bitter taste. It is mainly used in the perfumery and cosmetic industry. Citronella oil is a raw material for production of geranial, citronellal, hydroxy-citronellal and other similar high value perfumery bases. It is also widely used as a starting material for various aromatic chemicals used in scented soaps, sprays, deodorants, detergents, polishes, mosquito repellents etc. The essential oil bearing plants are playing a major role in commercial production of aromatic oils making India a major partner in the world scenario. It has become a profitable business in agricultural produce and post harvesting processing industry. Presently, India's position in world market is at top in the production of mints, grasses, spices, exotic flowers, roots and woody oil etc. At present 300 to 500 tons of oil is produced in India for the last 6 to 8 years in the state of Assam, Karnataka, Maharashtra, Tamil Nadu, West Bengal, and Uttar Pradesh. According to FFDC (Fragrance and flavour of development Centre, Govt. of India, Kanauji 2009-2010) the demand of citronella oil is 620 tonnes per year but the production 480 tonnes per year in India. The country facing deficit of 140 tonnes oil per year. It would be justified to accept that inter cropping system will attract increasing attention to overcome ecological constraints.

In India, maize is third most important cereal crop after rice and wheat. It occupies about 8.7 million hectare area with the production of 21.52 million tonnes having average productivity of 2474 Kgha-1contributing nearly 8.0 percent in the national food basket. (Anonymous, 2012. Directorate of economics and statistics, Department of Agriculture and Cooperation, Govt. of India). In Uttar Pradesh, the area, production and productivity of maize are 0.78 million hectare, 1.19 million tonnes and 1504 kg ha-1 respectively. (Anonymous, 2012.Directorate of economics and statistics and Crop insurance Govt. of Uatter Pradesh).

Maize grain contains about 10% protein, 4% oil, 70% carbohydrates, 2.3% crude-fibre, 10.4% albuminoids, and 1-4% ash. Besides this, maize grain also contains significant quantity of vitamin A, nicotine acid, riboflavin and vitamin E, Maize is fairly high in phosphorus. Maize protein 'Zein' is deficient in tryptophan and lysine, the two essential amino acids. Maize is called 'Queen of cereals'. It is capable of utilizing solar radiation due to its large leaf area and has the highest photosynthetic rate. (Kumar, 2011)

MATERIALS AND METHODS

The experiment was laid out in field No. 03 at Student Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) India during Kharif season 2011-12. The farm is located in the main campus of university. The experiment was laid out in randomized block design with different combination [sole citronella, sole Maize, citronella + Maize (1:1), citronella + Maize (2:1) and citronella + Maize (2:2)] each replicated thrice.

The university is situated in indo-gangetic alluvial tract of Central Plain Zone of U.P. that is come in agro-climatic zone-V. In order to determine the physico-chemical characteristics and fertility status of experimental field, the soil samples were collected randomly from the six places of the field to the depth of 0-15 cm with the help of soil sugar prior to fertilizer application. The soil samples of all the places were mixed together to form a composite sample for mechanical and chemical analysis. The soil analysis was done in the department of agronomy in this university.

Geographically, Kanpur is situated in subtropical region. It is situated at an elevation of 125.9 meter above mean sea level, 260200 350North latitude and 800180350 East longitudes. It is situated in the alluvial belt of Indo-Gangetic plain in the Central Part of Uttar Pradesh, which comes into Agro-climatic zone-V. Normally the climate of the area is semi-arid with hot dry summer and moderate to severe cold during winter. The average annual precipitation of the area varies from 800 to 900 mm with a mean annual precipitation of about 818 mm, mainly through monsoon rains confined within June to last week of September with occasional frost and shower in winter season from North-East monsoon during December and January.

The number of harvests, which can be taken during a year, depends upon the growth of the plants. The leaves are ready for first harvest, about 5- 6 months after planting 20 cm above the ground level. The second and subsequent harvests can be taken thereafter at 3-4 months interval. Distillation was done by the process of steam distillation. The distillations equipment consists of a boiler in which steam is produced, a distillation tub for distilling the grass, a condenser and 2-3 separators.

Land equivalent ratio is the relative land area under sole crops i.e. required to produce the yield achieved in inter cropping. In the present experiment the LER was estimated by following formula /equations.

$$LER = \frac{\text{Yield of citronella in intercropping}}{\text{Yield of citronella in sole cropping}} + \frac{\text{Yield of Maize in intercropping}}{\text{Yield of Maize in sole cropping}}$$

RESULTS AND DISCUSSION

Effect of cropping system on citronella:-

The cropping systems significantly affected the growth attributes (plant height and number of tillers/m row length) at 60 DAS (Table1) in the experimentation. This may be due to optimum spacing available for the plants in sole cropping as compared to other combinations of cropping systems. Such higher growth performance in sole crop as compared to intercropping system has also been observed by Patra et al. (2005). It is also clear from the result that next to citronella sole, C: M (2:1) row ratio treatment was also recorded significantly superior in the characters like plant height at Knee-high stage, Tasseling stage and maturity stages of crop growth over all the treatments and at par with C:M (2:2). The intercrop was affected due to the presence of inter and intra-specific competition between main crop and the intercrop (Maize) for growth resources such as nutrients, moisture and solar radiation due to change in crop geometry as compared to sole crop.

The results of the present investigation are in close conformity with the findings of Patra et al. (2005). The Highest herbage yield 186.38 q/ha was recorded in citronella sole which was significantly superior over rest of the treatments followed by 2:1 row ratio of citronella + Maize 127.19q/ha in (Table-1). This may be due to optimum spacing available for the plants. The higher growth performance in sole crop as compared to intercropping system has also been observed by Patra et al. (2005). The intercrop was affected due to the presence of inter and intra-specific competition between main crop and the intercrop (Maize) for growth resources such as nutrients, moisture and solar radiation due to change in crop geometry as compared to sole crop. The results of the present investigation are in close conformity with the findings of Sher et al. (2008).

Table - 1 : Effect of intercropping system on plant height, number of tillers and Herbage yield of citronella

Treatment	Plant height at harvest stage (cm)	Number of tillers at harvest stage	Herbage yield (qha^{-1})
Citronella sole	114	77.84	186.38
C:M (1:1)	107.25	76.68	95.93
C:M (2:1)	109.25	76.92	127.19
C:M (2:2)	75.04	76.95	95.02
SEm±	0.71	0.49	0.28
CD (P=0.05)	1.54	NS	0.85

Effect of cropping system on Maize :-The final plant population recorded at harvest stage significantly highest in sole and 1:1 row ratio stand of Maize followed by 2:1 and 2:2 row ratio of citronella + Maize intercropping system. Growth attributes plant height of Maize at different stages were significantly influenced due to the cropping systems and highest under (C: M 2:1) cropping systems at Knee-high stage, Tasseling stage and maturity stages of crop growth (Table 2) the plant height of Maize was significantly higher in citronella + Maize intercropping (1:1) & sole at Knee-high stage, Tasseling stage and maturity stages of crop growth (Table 2). The highest values of growth and yield attributing characters (Number of cob/ plant, Length of cob (cm), Number of kernel row per cob and Number of kernel per cob were recorded under (C: M 2:1) cropping systems, Girth of cob (cm) were recorded under (C: M 1:1) and yields of Maize were recorded under sole cropping as compared to intercropped in various combinations with citronella in (Table 3). However, in the yield attributes better under citronella + Maize intercropping (2:2) (Table 3). This may be due to optimum spacing available for the plants such higher growth performance in sole crops as compared to intercropped ones has also been observed by Singh and Jadhav (2003). There was a general reduction in the plant population of Maize at later stages due to inter and intra-specific competitions under intercropping system. It might have occurred due to the presence of dominant competition between main crop and the intercrop (Maize) because of vigorous growth of citronella (Myaka et al. 2006). This could be attributed to the

Table - 2 : Effect of intercropping system on growth attributes of Maize.

Treatment	Plant population m^{-2}		Plant height (cm)		
	Initial	Harvest	Knee-high stage	Tasseling stage	Maturity stage
Maize sole	7.64	7.1.	38.87	158.87	188.62
C:M (1:1)	7.31	6.91	37.87	158.76	188.25
C:M (2:1)	7.24	6.91	39.37	160.25	189.68
C:M (2:2)	7.14	6.68	38.06	158.31	187.37
SEm±	0.33	0.17	0.21	0.27	0.33
CD (P=0.05)	NS	NS	0.68	0.89	1.09

dissimilar conditions of plant growth and development of Maize as was also evident in growth attributes (plant height, number of cob /plant, length of cob (cm), girth of cob (cm) number of kernel row per cob and number of kernel per cob). Such conditions increased the competition among plants for nutrients, soil moisture and sunlight resources (Ansari et al. 2012). The results of the present investigation are in close conformity with the findings of Marrer et al. (2007) and Ghosh et al. (2009). Cropping systems had significant effect on grain, stalk and biological yield of Maize. The highest biological yield, grain yield and Stover yield was recorded in Maize sole which was significantly superior to all other treatment in the experimentation. The harvest index has been recorded non-significantly higher under C: M 2:1. Similar observations were also made by Ansari et al. (2014). Citronella + Maize (2:2) intercropping system fetched higher net returns as well as B: C ratio over sole and other combinations due to more combined yield. This might be due to beneficial effect of intercropping system which resulted more in Maize, equivalent yield as compared to either of the sole crops and combinations. Similar results were reported by Sharma et al. (2010).

Effect of cropping system on system productivity and economics: Citronella sole cropping system fetched higher net returns as well as B: C ratio over intercrops. Among intercropping system, citronella + Maize (2:1) intercropping system gave higher economic profit. This might be due to beneficial effect of intercropping system which resulted more in Maize equivalent yield as compared to either of the sole crops and combinations. Intercropping systems showed improvement in citronella equivalent oil yield (CEOY) (Table 4), net returns and B: C ratio (Table4). The citronella sole cropping system gave significantly the highest citronella equivalent oil yield, net returns and B: C ratio followed by citronella + Maize (2:1) and citronella + Maize (1:1) intercropping system than other cropping systems. Citronella sole system on an average fetched (180575.00) followed by citronella: Maize (2:1) (97857.10) net returns (Table 4). The higher B: C ratio was recorded under citronella sole (10.77) followed by citronella: Maize (2:1) (4.78) compare to other cropping systems. The results are in accordance with the findings of Saikia et al. (2006). Similar results were reported by Sharma et al. (2010). It was due to similar citronella oil yield under intercropping system as that of its sole stand, and additional yield of Maize as a bonus in intercropping system. The results are in accordance with the findings of Saikia et al. (2006).

Table - 3 : Effect of intercropping system on yield attributes and yields of Maize.

Treatment	Number of cob/ plant	Length of cob (cm)	Girth of cob (cm)	Number of kernel row per cob	Number of kernel per cob	Biological yield (q/ha)	Grain yield (q/ha)	Stover yield (q/ha)	Test weight (g)	H.I.
Maize sole	1.50	15.23	5.99	11.25	352.66	153.06	38.02	114.97	248.93	25.25
C:M (1:1)	1.50	15.80	6.49	11.50	355.06	80.54	20.04	60.91	243.95	25.37
C:M (2:1)	1.75	16.17	5.91	12.25	357.41	51.74	13.17	38.57	245.50	25.44
C:M (2:2)	1.50	15.80	5.49	11.75	354.75	82.50	20.24	62.73	239.25	24.16
SEm±	0.29	0.24	0.24	0.42	0.93	0.57	0.23	0.48	1.22	0.27
CD (P=0.05)	NS	0.78	0.79	NS	3.02	1.86	0.76	1.58	3.95	0.87

Table - 4 : Effect of cropping system on Citronella oil equivalent yield, net returns, B: C ratio and land equivalent ratio

Treatment	CEOYqha^{-1}	Net returns (Rs.ha^{-1})	B:C ratio	LER
Citronella sole	205.12	180575.00	10.77*	1.00
Maize sole	47.42	25572.5	1.30	1.00
C:M (1:1)	105.58	79168.04	3.74	1.01
C:M (2:1)	124.53	97857.10	4.78	1.02
C:M (2:2)	105.05	78664.54	3.72	1.01
SEm±	0.47	-	-	-
CD (P=0.05)	1.37	-	-	-

*Highest B: C ratio of sole citronella because IInd year planted crop of cultivation.

Effect of cropping system on land equivalent ratio: The LER value in intercropping system indicated yield advantage over sole stand due to better land utilization. The higher LER values in intercropping, i.e.1.01 to 1.02 clearly indicate 1 to 2% advantage over their sole stand (Table 4). The results are in accordance with the Ghosh et al. (2009).

CONCLUSION

Thus results of the present investigation clearly demonstrate that citronella sole cropping followed by Maize + citronella intercropping system (2:1) can be practiced to achieve better high yield as well as B: C ratio than other cropping system in sandy loam soils of central U.P.

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Journal of Natural Resource and Development 13 (1) 88-98, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

MOLECULAR TAXONOMY OF HAMMERSCHMIDTIELLA INDICUS USING SMALL SUBUNIT (18S) OF RIBOSOMAL DNA SEQUENCE FROM MEERUT, INDIA

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Received : 12.01.2018 Accepted : 15.03.2018

ABSTRACT

Molecular markers have often been used for taxonomic identification and phylogenetic analyses in different species groups. Evolution of rDNA is relatively independent of changes in morphology, and analyses of these genetic data have been shown to provide good phylogenetic resolution. So, it was decided to perform a phylogenetic analysis on species of the genus, Hammerschmidtiella indicus based on ribosomal DNA (rDNA) sequences. In the present study, phylogenetic relationships of species of the genus were investigated using nucleotide sequences of the region of 18S rDNA. Phylogenetic analyses were performed for primary sequence data as well as using neighbour-joining and maximum-parsimony approaches.

Key words : *Hammerschmidtiella indicus, rDNA, 18srDNA, rRNA, Phylogenetic analysis*

INTRODUCTION

Recently molecular markers have often been used for taxonomic identification and phylogenetic analyses in different species groups. Systematics and taxonomy of nematodes have changed substantially after introduction of DNA sequencing and genomic studies (Aleshin et. al., 1998; Blaxter et. al., 1998; De Ley and Blaxter, 2002 and 2004; Holterman et. al., 2006; Meldal et. al., 2007 and Zhao and Buckley, 2009). The ribosomal RNA gene represents a well conserved gene that evolves relatively slowly. Ribosomal DNA genome sequences are widely used in the evolutionary studies of many different groups of organisms. Ribosomal RNA gene provide the utility of gene order in reconstructing phylogenies, and the differences in base composition and codon usage are currently progressive areas of research using comparative genomics. This study on comparative rDNA genomics, suggests that nematodes represent a good model to study various aspects of genetics and evolution. Evolution of rDNA is relatively independent of changes in morphology, and analyses of these genetic data have been shown to provide good phylogenetic resolution (Nadler, 1992; Heise

et.al., 1995). In fact, several recent studies of eukaryotes used rDNA sequences in phylogenetic analyses to make strong inferences of ancestor descendant relationships when analyses of morphological data only resulted in more unanswered questions (Carmean et.al., 1992; Sidow and Thomas, 1994). In addition, the analysis of rDNA nucleotide sequences has recently been used to access phylogenetic relationships among taxa of both higher and lower organisms (Hillis and Dixon, 1991; Sidow and Thomas, 1994; Halanych et.al., 1995). Choosing the appropriate segment of DNA within the genome of an organism is a critical step in any phylogenetic study (Hillis and Dixon, 1991; Derr et.al., 1992). The region of choice should have enough variability among the taxa in question to allow an estimation of their historical relationships. This variation must not be too great so as to obscure past ancestor-descendant relationships. The rRNA gene that has been used in molecular systematics is the large subunit rRNA gene (28S) and small subunit rRNA gene (18S). The rRNA gene has been shown to be useful in estimating phylogeny because it contains regions that evolved slowly and other regions evolved more quickly. Thus this gene has been selected to infer divergences used rDNA to examine the evolutionary relationships among animal parasitic nematodes.

During the course of study, it was decided to perform a phylogenetic analysis on species of the genus Hammerschmidtiella indicus based on ribosomal DNA (rDNA) sequences. In the present study, phylogenetic relationships of species of the genus were investigated using nucleotide sequences of the region of 28S rDNA and 18S rDNA.The investigator is convinced that the findings of present work will provide a base line for the study of molecular taxonomy of these species and validating their specific status. Review of literature reveals that some taxonomic studies were carried out using molecular tool by foreign workers using either 18S rDNA or 28S rDNA. Nadler et.al, (2007) studied 18S rDNA contents of T. krausi. Moreover, Koubkova et.al, (2006) worked out 18S rDNA contents of Thelastoma gueyei. Spiridonov (2009) worked out 28S rDNA and 18S rDNA of Leidynema appendiculata, L. portentosae, Hammerschmidtiella cristata and H.diesingi and more recently, Spiridonov and Guzeeva (2009) studied 28S rDNA contents of Thelastoma sp.

MATERIALS AND METHODS

Parasite was excised out carefully from alimentary canal of Periplaneta americana from Meerut(29801'N, 77845'E), U.P., India. Parasite was identified up to the level of species morphologically using existing taxonomic keys and descriptions. The parasite found is Hammerschmidtiella indicus Singh and Malti, 2003. For genomic DNA extraction, one specimen of nematode parasite was fixed in either 95% or 100% Ethanol. DNA was extracted from samples using the Qiagen DNeasy Tissue Kit as per the manufacturer's instructions. Polymerase chain reaction (PCR) for the amplification of 18S ribosomal DNA was undertaken using the specifically designed primers. A total volume of 25 µl was used for the PCR reaction. Each reaction contained 10X PCR buffer, 0.4 mM dNTP, 10 pM of each primer pair, 3 µl template DNA, 1 U Taq polymerase (Biotools) and Milli-Q water. The PCR assay was carried out in an Eppendorf Master Cycler Personal for 35 cycles. The amplification profile consisting of 3 min. at 94 0C, 30 s at 94 0C, 45 s at 56 0C and 1 min at 72 0C, followed by final extension at 72 0C for 10 min. The PCR products were visualized using ethidium bromide on a 1.5% agarose TBE gel. The products were then purified by Chromous PCR cleanup kit (# PCR 10), according to

manufacturer's instructions. Both DNA strands were sequenced using a Big Dye Terminator ver. 3.1 cycle sequencing kit in an ABI 3130 Genetic Analyzer. Same PCR primers were used for sequencing reaction. Primer sequences desinged in the study is (Forward primer 5'- AAACGGCTACCACATCCAAG-3' and Reverse primer 5'- CCAAGCACATGAACCAAATG-3'). Phylogenetic analysis of 18S rDNA sequence was used to perform the phylogenetic analysis of the sequences. Sequences were uploaded on NCBI to search for the most similar reference sequences and positions of the 18S gene were determined with the help of BLAST (available at www.ncbi.nlm.nih.gov). Subsequently, nucleotide sequences of various species were aligned using the aligning tool Clustal W (Thompson et.al., 1994). The sequences were entered in the MEGA for construction of the phylogenetic tree. Data were analyzed using maximum parsimony (MP) and neighbor-joining (NJ) methods by using MEGA version 4.0 (Tamura et.al., 2007). Pairwise comparisons were made by using Kimura-2 parameter model (Kimura, 1980). Nucleotide sequences of related sequences and Electropherogram of sequencing sample is also provided in the thesis. The base pair sequence of small subunit of ribosomal DNA of parasites submitted to NCBI GenBank under the accession number GU968649.

RESULTS AND DISCUSSION

Hammerschmidtiella indicus Singh and Malti, 2003, (Table 1-2 and Fig.1-4).The rDNA (18S) gene sequence was obtained from specimens of H. indicus Singh and Malti, 2003, 18S sequence aligned using the clustal W (Thompson et. al., 1994) to perform the phylogenetic analysis. The reference sequences used in this study are listed in Table 1. Pairwise comparisons of the sequences were made (Table 2) using Kimura-2 parameter model (Kimura, 1980). The phylogenetic reconstructions inferred from analysis of the 18S rDNA sequences exhibit significant resolution for this species of the nematode. The Electropherogram of sequencing sample is also provided as shown in Fig. 1. DNA sequences of closely related species were also download and used in the phylogenetic analysis. Phylogenetic analysis was performed using MEGA ver. 4.0 (Tamura et.al., 2007). Phylogenetic trees were constructed from this using the neighbour-joining (NJ) and maximum parsimony (MP) method with a high degree of confidence (Fig. 2 & 3). Bootstrap resampling (1,000 pseudoreplicates) was done and a bootstrap consensus tree produced. Both the methods yielded phylogenetic trees with similar topology and approximate relatively bootstrapped values. These sequences were aligned with the 18S rDNA genes and revealed clear differences in nucleotide sequences among different species in comparison (Fig. 4).

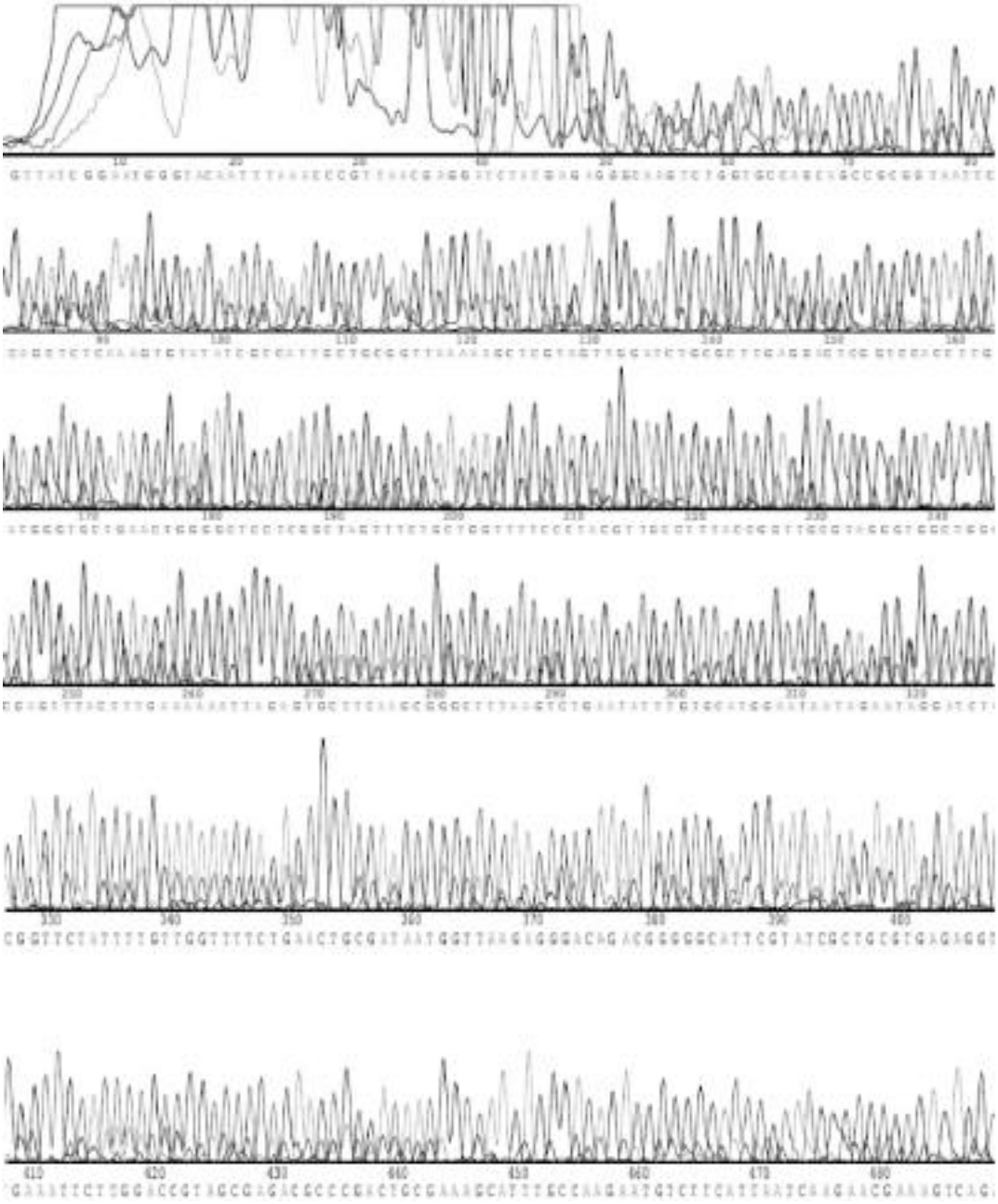
Table 1. Reference sequences (18S) used in this study, their geographical origins as well as accession numbers.

Species	Location/Source	Genbank Accession No.
Hammerschmidtiella indicus†	India	GU968649†
Leidynema portentosae	USA	EF180073
Skrjabinema sp.	USA	EF180060
Thelastoma icemi	India	GU968647
Thelastoma krausi	USA	EF180068
Oxyuris equi	USA	EF180062
Aspiculuris tetraptera	USA	EF464551

†Species sequenced in the present study

Table 2. Kimura 2- parameter distances comparison of sequence differences (in %) in the 18S among species. †Species sequenced in the present study.

	H. indicus†	A. tetraptera	L. portentosae	T. icemi	S. sp.	T. krausi	O. equi
H. indicus†							
A. tetraptera	0.0221						
L. portentosae	0.0249	0.0193					
T. icemi	0.0264	0.0292	0.0236				
S. sp	0.0278	0.0166	0.0235	0.0378			
T. krausi	0.0335	0.0264	0.0208	0.0364	0.0321		
O. equi	0.0406	0.0307	0.0363	0.0466	0.0307	0.0421	



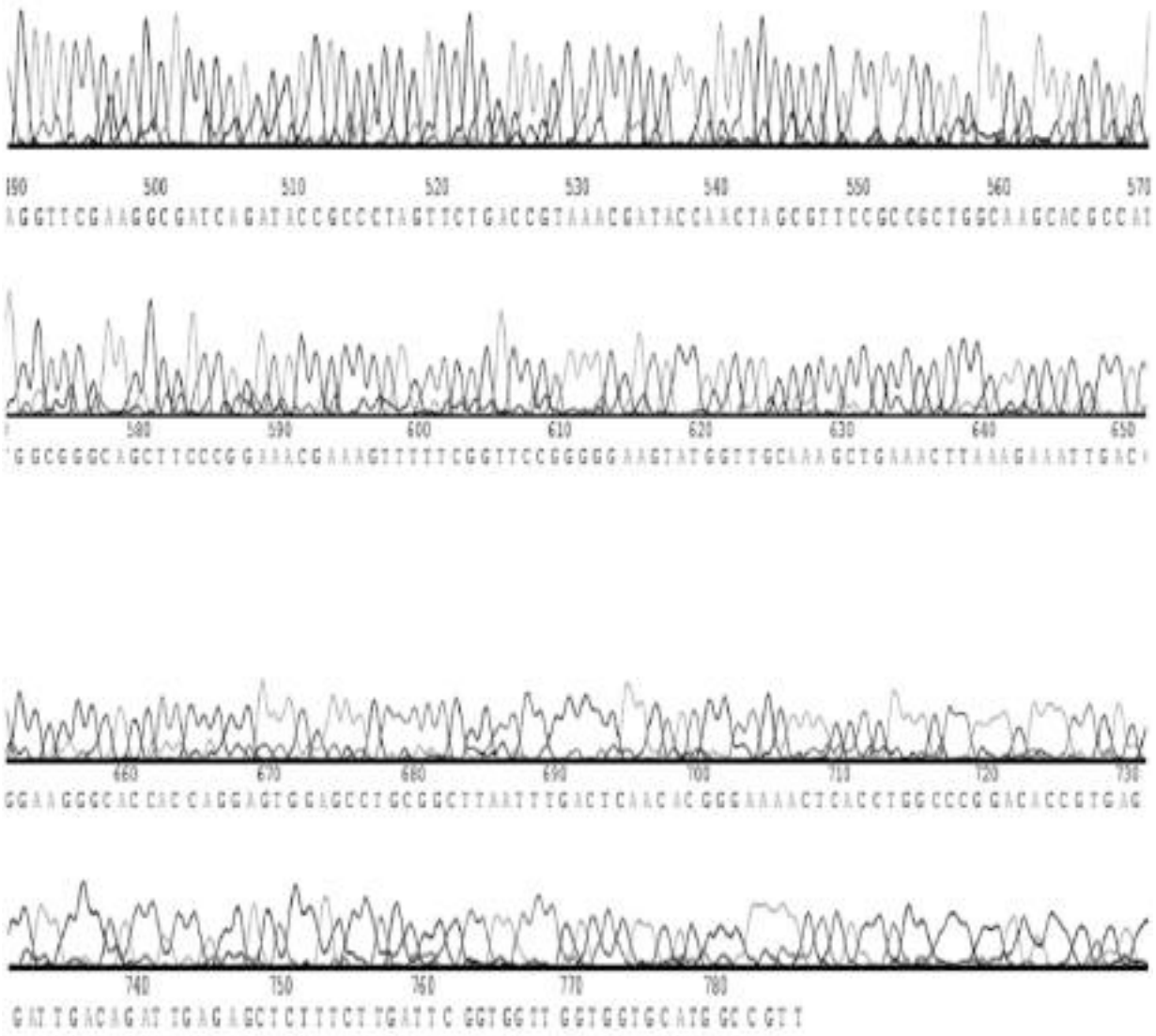


Fig. 1 Electropherogram

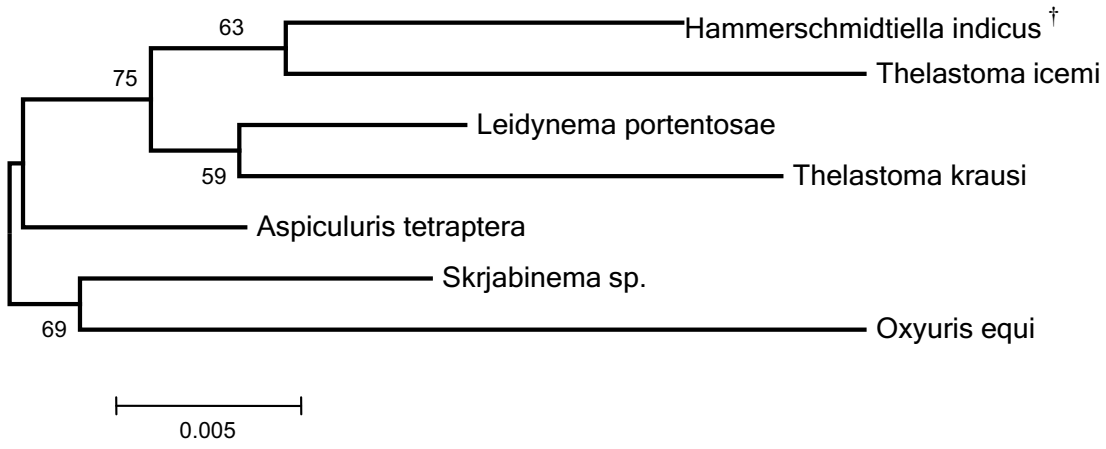


Figure 2. A phylogenetic tree constructed by neighbour-joining method (1,000 bootstraps) for 18S region. Bootstrap values (as percentages) are shown at internal nodes. The scale bar indicates the proportion of sites changing along each branch. †Species sequenced in the present study.

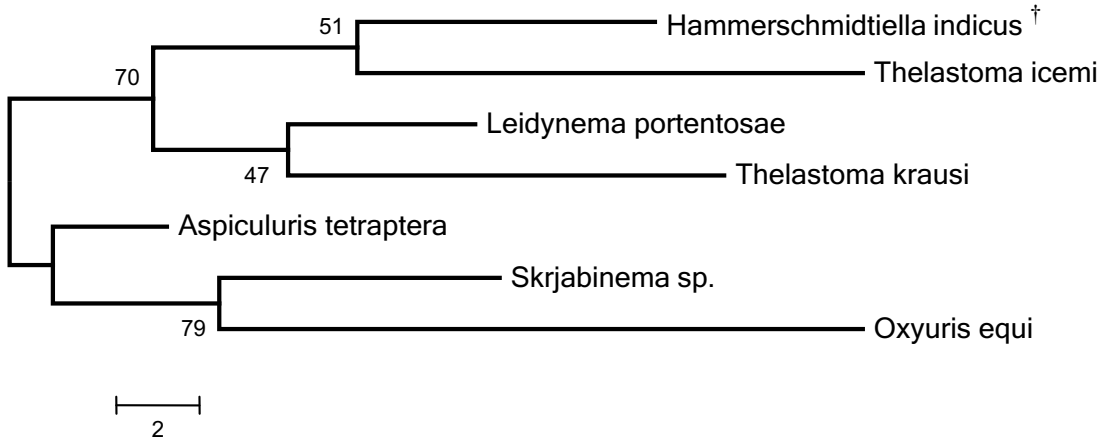


Figure 3. Phylogenetic relationship of the species H. indicus inferred from the 18S region using the Maximum Parismony (MP) method (1,000 bootstraps). The scale bar indicates the proportion of sites changing along each branch. †Species sequenced in the present study.

Figure 4. Alignment of 18S sequences for comparative purposes of different species from different geographical locations showed nucleotide identical to H. indicus. Dots indicate identity with the first sequence and dashes are inferred insertion-deletion.

Hammerschmidtiella indicus ------GTTA TCGGAATGGG TACAATTTAA ACCCGTTAAC GAGGATCTAT [50]
Leidynema portentosae AGGCCG.... ....T..... ..... [50]
Skrjabinema sp. AGGCCG.... ....T..... ..... [50]
Thelastoma icemi AGGCCG...G GA..... .... [50]
Thelastoma krausi AGGCCG.... .... [50]
Oxyuris equi AGGCCG.... .... [50]
Aspiculuris tetraptera ---------- ---------- ---------- ---------- ---------- [50]

Hammerschmidtiella indicus GAGAGGGCAA GTCTGGTGCC AGCAGCCGCG GTAATTCCAG CTCTCAAAGT [100]
Leidynema portentosae .... [100]
Skrjabinema sp. .... [100]
Thelastoma icemi .... [100]
Thelastoma krausi .... [100]
Oxyuris equi .... [100]
Aspiculuris tetraptera ---.....- .... [100]

Hammerschmidtiella indicus GTATATCGTC ATTGCTGCGG TTAAAAAGCT CGTAGTTGGA TCTGCGCTTG [150]

Leidynema portentosae .... [150]
Skrjabinema sp. .... [150]
Thelastoma icemi .... [150]
Thelastoma krausi .... [150]
Oxyuris equi ....C.A..... [150]
Aspiculuris tetraptera .... [150]

Hammerschmidtiella indicus AGGACTCGGT CCACCTTGAT GGGTGCTGAA CTGGGGCTCC TCGGCTAGTT [200]
Leidynema portentosae .....T... .....C-.T. .....A-... .....-.... .....CG. [200]
Skrjabinema sp. .....T... .....AATT. T..... ..AA.-...T .....T.G [200]
Thelastoma icemi ....C-.T. .....A-... .....-.... .....AA [200]
Thelastoma krausi .A..... .....C-TC. .....A-... .....-...T .....CG. [200]
Oxyuris equi .....T... .....A-TT. C..... ...A.-.... ..A..... [200]
Aspiculuris tetraptera ....A-TT. T..... .....-.... .....CAA [200]

Hammerschmidtiella indicus -TCTGCTGGT TTTCCCTACG TTGCCTTTAC CGGTTGCGTA GGGTGGCTGG [250]
Leidynema portentosae -.G..... .....G.. ....C..... .....A. [250]
Skrjabinema sp. A.G..... ....A..... ....C..... .....A. [250]
Thelastoma icemi -.A..T.... .....G.. .....C.. ....C..... .....A [250]
Thelastoma krausi -.G..... .....G.A ....C.T... .....A. [250]
Oxyuris equi A.G..... .....T.... .....G.T ...CC..... .....A. [250]
Aspiculuris tetraptera T.G..... ....C..... .....A. [250]

Hammerschmidtiella indicus CGAGTTTACT TTGAAAAAAT TAGAGTGCTT CAAGCGGGCT TTAA-GTCTG [300]
Leidynema portentosae .... A.....A ..TT-..... [300]
Skrjabinema sp. .... A..... ..C.A..... [300]
Thelastoma icemi ....A ..T.-..... [300]
Thelastoma krausi .... A..... ....-.C... [300]
Oxyuris equi .... A....A...G ..C.-.C... [300]
Aspiculuris tetraptera .... A..... ....-..... [300]

Hammerschmidtiella indicus AATATTTGTG CATGGAATAA TAGAATAGGA TCTCGGTTCT ATTTTGTTGG [350]
Leidynema portentosae .... [350]
Skrjabinema sp. .... [350]
Thelastoma icemi .... .T..... ..... [350]
Thelastoma krausi ....A.. .....A... ..... [350]
Oxyuris equi ....C... ..... [350]
Aspiculuris tetraptera .... [350]

Hammerschmidtiella indicus TTTTCTGAAC TGCGATAATG GTTAAGAGGG ACAGACGGGG GCATTCGTAT [400]
Leidynema portentosae .....T. ..A..... .... [400]
Skrjabinema sp. ....A..... .... [400]
Thelastoma icemi ....A..... .... [400]
Thelastoma krausi .....T. ..AA..... .... [400]
Oxyuris equi .....GT. C.A..... .... [400]
Aspiculuris tetraptera .....T. ..A..... .... [400]

Hammerschmidtiella indicus CGCTGCGTGA GAGGTGAAAT TCTTGGACCG TAGCGAGACG CCCGACTGCG [450]
Leidynema portentosae ....T..... [450]
Skrjabinema sp. ....T..... [450]
Thelastoma icemi .... [450]
Thelastoma krausi ....T..... [450]
Oxyuris equi .... [450]
Aspiculuris tetraptera .... [450]

Hammerschmidtiella indicus AAAGCATTTG CCAAGAATGT CTTCATTAAT CAAGAACGAA AGTCAGAGGT [500]
Leidynema portentosae .... [500]
Skrjabinema sp. .... [500]
Thelastoma icemi .... [500]
Thelastoma krausi .... [500]
Oxyuris equi .... [500]
Aspiculuris tetraptera .... [500]
Hammerschmidtiella indicus TCGAAGGCGA TCAGATACCG CCCTAGTTCT GACCGTAAAC GATACCAACT [550]
Leidynema portentosae .... [550]
Skrjabinema sp. .... [550]
Thelastoma icemi .... [550]
Thelastoma krausi .... [550]
Oxyuris equi .... [550]
Aspiculuris tetraptera .... [550]

Hammerschmidtiella indicus AGCGTTCCGC CGCTGGCAAG CACGCCATGG CGGGCAGCTT CCCGGAAACG [600]
Leidynema portentosae ....T... .... [600]
Skrjabinema sp. ....T... .... [600]
Thelastoma icemi .....T .....A .....T..A .... [600]
Thelastoma krausi ....A .....T... .... [600]
Oxyuris equi ....A .....T... .... [600]
Aspiculuris tetraptera ....T... .... [600]

Hammerschmidtiella indicus AAAGTTTTTC GGTTCCGGGG GAAGTATGGT TGCAAAGCTG AAACTTAAAG [650]
Leidynema portentosae .... [650]
Skrjabinema sp. .... [650]
Thelastoma icemi .... [650]
Thelastoma krausi .... [650]
Oxyuris equi .... [650]
Aspiculuris tetraptera .... [650]

Hammerschmidtiella indicus AAATTGACGG AAGGGCACCA CCAGGAGTGG AGCCTGCGGC TTAATTTGAC [700]
Leidynema portentosae .... [700]
Skrjabinema sp. .... [700]
Thelastoma icemi .... [700]
Thelastoma krausi .... [700]
Oxyuris equi .... [700]
Aspiculuris tetraptera .... [700]

Hammerschmidtiella indicus TCAACACGGG AAAACTCACC TGGCCCGGAC ACCGTGAGGA TTGACAGATT [750]
Leidynema portentosae .... [750]
Skrjabinema sp. .... [750]
Thelastoma icemi .... [750]
Thelastoma krausi .... [750]
Oxyuris equi .... [750]
Aspiculuris tetraptera ....T..... ..... [750]

Hammerschmidtiella indicus GAGAGCTCTT TCTTGATTCG GTGGTTGGTG GTGCATGGCC GTT [793]
Leidynema portentosae .... [793]
Skrjabinema sp. ..T..... .... [793]
Thelastoma icemi .... [793]
Thelastoma krausi .... [793]
Oxyuris equi ..T..... .... [793]
Aspiculuris tetraptera ..T..... .... [793]

Ribosomal DNA sequences are widely used in the evolutionary studies of many different groups of organisms. rDNA provide a closed system within which the mechanisms of genome rearrangement, the utility of gene order in reconstructing phylogenies, and the differences in base composition are currently progressive areas of research using comparative genomics. Ribosomal comparative genomics and phylogenetic reconstruction could allow us to gain insights into several aspects of the rDNA evolution in animals including parasites.

Hammerschmidtiella indicus is the first species of this genus to have small ribosomal subunit rRNA gene regions sequenced for the purposes of species discrimination. However, further sequences are required from additional species of the genus Hammerschmidtiella to reveal the position within the nematoda. Their validity is also strongly supported by molecular evidence inferred from rDNA sequence. The tree topologies derived from the phylogenetic analysis inferred from the 18S rDNA data-set is in agreement that it is closely related sister-taxa genetically viz., L. portentosae, T. icemi and A. tetraptera. Further studies with additional molecular markers are needed to determine the divergence between H. indicus and other nematodes.

CONCLUSION

The position of H. indicus in the phylogenetic trees reconstructed confirms its placement within family Thelastomatidae. This study also indicates that molecular markers, such as those provided by rDNA, are useful markers for distinguishing sister-species and is helpful in discriminating species where there is species overlap and co-infection of the same definitive host especially when morphological differences are often difficult to determine. However, nematode molecular phylogenetic studies are still at an early stage.

ACKNOWLEDGEMENTS

The author is thankful to Head, Department of Zoology, C.C.S. University, Meerut, for providing laboratory facilities.

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Journal of Natural Resource and Development 13 (1) 99-104, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

IMMUNOPATHOLOGICAL ALTERATIONS IN THYMUS INDUCED BY CADMIUM ACETATE IN KUROILER CHICKS

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Received : 08.04.2018 Accepted : 09.05.2018

ABSTRACT

The present study has been demonstrated that along with cadmium acetate intoxication in thymus of Kuroiler chicks. Cadmium a potent immunotoxicant has been reported to affect thymocytes (immunecytes) in human and animals. These affects exists in chicks is still unclear. To delineate the Immunotoxicology Cadmium on the chicken in vitro effect of Cadmium on thymus of Kuroiler chick. The 20 days old chicks were divided into two groups viz, control and exposed with sub-lethal dose of cadmium acetate (6.8 mg/Kg body weight). After 20 and 40 days of post exposure chick were dissect out from thymus of control and treated group. In the present study it was observed that cadmium acetate exposure in the Kuroiler chicks also induced some pathological alterations in thymus. The capsular wall and cortical region of thymus in experimental group showed marked ruptured and vacuolization at various places. In medullary region the lymphocyte populations were found to be depletion and reticular cells view degenerated. Some pathological changes were also present like picosis, Karyolysis and cloudy swelling etc.

Key words : *Kuroiler chicks, sub lethal dose, cadmium acetate, pathological alterations.*

INTRODUCTION

Immunology is the branch of biochemical science concerned with all aspects of the immune system in all multi-cellular organisms. Environment is full of toxicants such as heavy metals (cadmium, nickel and arsenic), pesticides and drugs which cause harmful effect on health of human being and domesticated animals.

Kuroiler chick is a layer and meat produces breed and most commonly used for egg and meat production. Cadmium is an

increasing pollutant which is toxic to liver, kidney, testes, bones and immune system (defense mechanism of body). Immune system works upon the basis of immune components (antibodies, B-cells, T-cells, macrophages, NK cells, mast cells etc.) which are produced by primary and secondary lymphoid organs.

Thymus is a primary lymphoid organ. It is a unique site for T-lymphocyte development and differentiation of various kinds of T-cells and production of thymic hormones like thymosine-α, thymosine-β, thymopoeitins and thymulin. It provides specialized environment for selection of rearranged clones which function appropriately in the adaptive immune system. This include positive selection of T-cells MHC restriction, negative selection against self reactivity. Thymus is known to export at least 6 different populations of γ/δ T-cells: T-cells, naïve CD4 and CD8 α/β T-cells, NKT cells and Intra-epithelial lymphocyte (IEL). T-cells after development, differentiation and maturation, migrate to different lymphoid organs which is referred as thymic emigration.

Koch (1973) observed that thymus lobes are extended from anterior cervical region to anterior thoracic region in birds. Kendall (1980) observed 7-8 separate lobes embedded in adipose tissue and each is encapsulated with a fine fibrous connective tissue capsule. White (1981) remarked that there were five pairs of thymic bodies in chickens, which are situated on each side of the neck superficial to the jugular veins and vagus nerve. Each lobe is divided into lobules by the septae invaded from the capsule. These lobes attain a maximum size of 6-12 mm in diameter by 3-4 months of age (Ciriaco, 2003).

Present studies have been taken to find immune-pathological alteration in thymus and also the recent thymic emigration, which would help in understanding the toxicity and also to find the ways and means to counteract toxins.

Experimental Design

Experimental Host- Kuroiler chicks
Toxicant used - Cadmium Acetate Cd(CH3COO)2
Dose of treatment - 6.8 mg/kg body weight
Post exposure examination - 20 days-Post treatment
Post exposure examination - 40 days- Post treatment
Group A - Control- 10 chicks (Untreated)
Group B - Exposed- 10 chicks (Treated with cadmium acetate)

MATERIALS AND METHODS

One day old 50 chicks were collected from local hatchery in Meerut. Fed on granulated maize and acclimatized to laboratory conditions. Acclimatized chicks were divided into 2 groups-

A. Control Group – untreated

B. Exposed Group- treated with cadmium acetate

Determination of median lethal dose: Stock solution of the metal cadmium was prepared by simple dilution techniques as given by Duodroft et al., (1951). The 72 hours LD50 values were found to be 68 mg/ kg body weight.

Determination of Sub-Lethal Dose: The sub-lethal concentration up to 20 and 40 day, these values were found 6.8 mg /kg body weight. As per experimental design chicks were sacrificed and the thymus tissues and blood were collected immediately. Present investigation was conducted on male Kuroiler chicks. Experiment protocol had been divided into parameters-Immuno-pathological studies of thymus.

Immunopathological Studies: Tissues of Thymus were taken for immune-pathological studies after 20 and 40 days of post exposure of both control and exposed group. Pieces of tissues kept in 10% formalin then stored at 70% ethanol and following procedure was used

to study-

Fixation of tissues in 10% formalin
↓
Washing with Distilled Water
↓
Dehydration with 70% Alcohol
↓
Then 90% Alcohol
↓
Then absolute Alcohol
↓
Tissue fixation and Embedded in Wax
↓
Section cutting with Microtome (5 µm thick)
↓
Staining with Hematoxylin and eosin
↓
Slide containing sections dehydrated
↓
Cleared in Xylol
↓
Mount in D. P. X.
↓
Microscopic Immunopathological Study

OBSERVATIONS

The immunopathological structure of the thymus observed using phase contrast microscope under 400X magnification. Photograph from the selected specimen were prepared for better illustration of the result.

Immunopathological studies of the Thymus:-

1. T. S. passing through thymus gland of male Kuroiler Chick after 20th day of post development:- The thymus gland was made up of the capsule, cortex and medulla. Capsule forming the outer most layer enclosing cortex and medulla. It was observed that capsule is indistinct but fused with cortex. Cortex contains white area in the T. S. The cortex was observed to contain large number of T-lymphocytes. These lymphocytes are found in the deeper cortex also and these lymphocytes are differentiated into smaller CD4 cells and larger CD8 cells. At certain places they are found to be concentrated.

Fig. 1:- T. S. passing through Thymus Gland of control group at 20th day, Showing capsular wall, cortex and medulla (400X)

2. Immunopathological alterations in thymus gland of male Kuroiler chick after 20th day of post treatment (Acute Exposure):- The various immunopathological changes reveal that capsule showed necrosis (rupture) at various places. The outer cortical area revealed less concentration of lymphocytes at various place. The substance of cortex showed haemorrhage showing presence of ruptured lymphocytes. The outer capsule and muscle layers were found to be disturbed. The lumen of the capsule also showed haemorrhage. The medulla showed less concentration of CD4 cells and CD8 cells.

Fig. 2:- T.S. passing through Thymus Gland of treated group at 20th day showing the medulla less concentration of CD4 cells and CD8 cells and capsule necrosis or ruptured (400X)

3. T. S. passing through thymus gland of male Kuroiler Chick after 20th day of post development:- This section reveals capsule, cortex and medulla. The cortex and medulla showed more concentration of lymphocytes. The concentration of lymphocytes was more pronounced in both cortex and medulla.

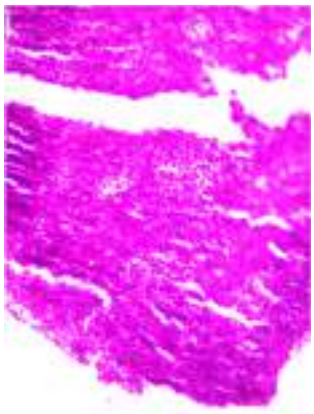

Fig. 3:- T. S. passing through Thymus Gland of control group at 40th day showing capsular wall, cortex and medulla (400X)

4. Immunopathological alterations in thymus gland of male Kuroiler chick after 40th day of post treatment (Acute Exposure):- The T. S. in this portin of the section revealed less differentiation between cortex and medulla because of inflammatory edema. Particularly some part of cortex showed more concentration of abnormal lymphocytes. The muscle layer found to be degenerated and disturbed. The inflammatory edema in this part of section was observed to be present everywhere smaller CD4 cells and larger CD8 cells were observed and cloudy swelling at certain laces was distinct. Thymic emigration was more distinct. T. S. passing through this part of section shows pronounced immunopathological changes. inflammatory edema was very distinct at various places. Wall of thymic capsule broken at very places and muscle layer completely dissolved. Internal epithelial lining of capsule was broken and obliterated. A various places presence of disturbed lymphocytes reveals haemorrhage. Thymic emigration was more distinct.

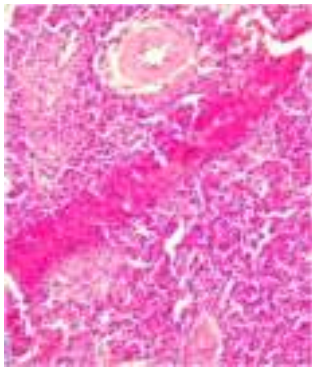

Fig. 4:- T. S. passing through Thymus Gland of treated group at 40th day showing medulla and thymic capsule and various lymphocytes (400X)

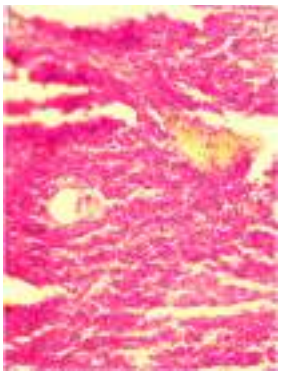

Fig. 5:- T. S. passing through Thymus Gland at 40th day of treated group showing severe inflammatory edema and pathogenesis in thymic capsule (400X)

RESULT AND DISCUSSION

The information about histopathology of thymus of Kuroiler chick is unavailable therefore the results in the present investigations are being discussed with available data on different species of breeds of birds. In present studies the thymus of Kuroiler chick was observed to be located into 2 long chains of lobes on either side of the neck and situated parallel to the jugular vein and vagus nerve. The findings about location of thymus

are agreement with Hodges (1974) in WLH chick, Muthu Kumaran et. al., (2011) in turkeys and Akhtar et. al., (2006) in Broiler chicken reported 6-8 lobes on each side of the neck. In turkey Sultana et. al., (2011) noted, 5 lobes on both side of neck left and right in the indigenous ducklings of Bangladesh. Bahadur et. al., (1992) revealed 6-9, 5-6, 4-7 lobes on right side and 5-9, 5-7, 4-6 lobes on left side in goose, native duck and white pickened duck respectively.

In present study it was observed that the number of lobes in Kuroiler chicks were 5-7 on both sides. The similarities in these findings might be due to species differences. The color of the thymus of Kuroiler chick is pale white to yellowish white and shape of lobe of thymus was observed to be elongated and flattened (Abdul Haseeb et. al., 2014). These observations are in agreement with the finding of Sultana et. al., (2011).

The Immunopathological architecture of thymus in present study is similar to the finding of King (1975) in WLH chicken and Kareem et. al., (2005). In Vencobb chicken. The population of T-cell lymphocytes in the cortex of the thymus in the present study was little denser rather than that of medulla of thymic lobules and was uniformed distribution.

ACKNOWLEDGEMENT

We are very grateful to the Head, Department of Zoology, C. C. S. University, Meerut for providing lab facility during the present research work.

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Journal of Natural Resource and Development 13 (1) 105-109, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

PREPARATION AND NUTRITIONAL QUALITY EVALUATION OF WHEY- BASED ORANGE BEVERAGE

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Received : 11.03.2018 Accepted : 05.04.2018

ABSTRACT

Whey is a useful source of protein, carbohydrates, vitamins, minerals and trace elements and has a low fat content. These minerals include monovalent sodium, potassium and chloride ions, magnesium, citrate, phosphate and excellent source of bioavailable calcium. In addition, orange juice is known to contain a high percentage of vitamin C, which is helpful in boosting the immune system. So, whey based orange beverages were prepared to provide nutritional and healthy beverage to maintain healthy status.

Key words : *Whey, nutritional, healthy.*

INTRODUCTION

Whey is the yellow-green, watery liquids that separates from the curd during the cheese making process (Smithers et.al., 1996), and contains nearly half of all solids found in whole milk (Chandan et.al., 1982).These solids include proteins, fat, minerals, and lactose. During the production of one pound of cheese, approximately nine pounds of whey are produced (Anonymous, 2002). Today, some whey is still used as animal feed, primarily the lactose component (Frank, 2001), while some whey is also spread on to the land in a process called land spreading. As land spreading restrictions tighten in the next few years, cheese makers will have to find alternative methods for disposing of or utilising whey (Casper et.al., 1999). Despite the fact that whey was viewed as a waste product in the past, worldwide production of whey was estimated at more than 80 billion litres of whey each year (Smithers et.al., 1996). Another estimate of the worldwide production of whey is 2.3 million tons of skim milk powder and 7 million tons of whey solids (de Wit,1998). As whey production continues to grow, whey solids must be made fit for human consumption. Much of the whey cannot be used its liquid form, and is instead spray dried into whey powder or further process by ultra filtration (Smithers et.al.,

1996). Sports drinks were first developed over thirty years ago for the purpose of rehydration (Roberts Jr., 2002).

Many studies have shown that orange juice can help reduce the risk of heart disease, which is because it can help improve circulation. Orange juice contains Folate, which plays a major role in the reproduction of new cells and can help with the healing process. So keeping in mind about the health benefits of all ingredients and new type of ready to serve whey based orange beverage is to be developed. The main ingredients consist of orange juice, whey, sugar and minor ingredients such as citric acid, colours, etc. The study was undertaken to evaluate physico-chemical, sensory characteristic and microbial analysis of the products and optimization of whey based orange beverage.

MATERIALS AND METHODS

Whey were prepared in the "Food processing Technology Laboratory" department of Food Processing Technology, S. Kula Women's college, Nambol, Kongkhampat. Fresh mature and fully ripe orange, sugar, were collected from Local Market of Manipur. Other ingredients such as citric acid and orange colour were used from Food Processing Technology laboratory.

Preparation of ingredient:

Fresh orange were purchased from Local market of Manipur to obtain juice consisted of manually peeling the fruits separating the seeds and extracting the juice by electric juicer. Paneer whey was obtained by heating milk at 85^{0}C and adding citric acid solution slowly by constant stirring. After few minutes milk curdles leaving behind whey. Then it is stained by muslin cloth. The whey was filtered and centrifuged to remove the fat. Fat separation was done at 45°C. To precipitate proteins whey was heated to 105°C at pH 4.6 and then was filtered and stored under refrigerated condition until use. The process is shown in the following flow diagram below.

Fresh milk
↓
Filtering
↓
Boiling
↓
Cooling at 85^{0}C
↓
Adding citric solution @ 2g per litre approximately
↓
Stirring the milk
↓
Staining by muslin cloth
↓
Fat and protein removal
↓
Stored at cool place

Fig-.1: Process for preparation of paneer whey

Development of the product: Whey based orange beverage was prepared with the following steps:

1. Fruit pulps were obtained by peeling of the skin manually.
2. The pulps were macerated in order to get the juice.
3. Filtration of the juice was done by using muslin cloth. It was then weight.
4. Prepare syrup by dissolving sugar, whey, citric acid and water. Filter and cool down.
5. When syrup cool down mix with orange juice and add colour, essence and preservative.
6. Filtration was done again after heating the mixture above 80^{0}C for about 15 minutes.
7. Fill in prewash bottle leave 1.25 cm head

space.

Optimization of ingredients: To get the best combination regarding taste, density, texture and appearance the proportions of sugar whey and orange juice were adjusted. Various amounts that were taken are given in the table number 1.

Sample	Orange juice (%)	Sugar (%)	Whey (%)	Water
O1(control)	25	15	-	60
O2	20	10	70	-
O3	25	15	60	-
O4	30	15	55	-

Table no.1. Optimization of ingredients in percentage

Sensory evaluation of whey based orange beverage: The products developed were subjected to sensory evaluation by a panel of five judges. The evaluation of the product was carried out by '9-point Hedonic scale'. Samples were evaluated for various attributes like colour, flavour, appearance, consistency, and over all acceptability.

Chemical analysis of whey based orange beverage: The nutrient composition i.e. pH, total solids (TS), acidity, ascorbic acid estimation by chemical analysis using standardized procedure of AOAC (1980) and cost analysis of the product. Estimation of pH by pH meter, TS by using refractometer and the acidity of the final product was estimated by titrating with 0.1N NaOH using (AOAC 1984) phenolphthalein indicator.

Microbiological analysis of whey based orange beverages:

Cleaning and sterilization of glassware was done by washing them thoroughly with detergent or sulphuric acid, glassware after drying was wrapped with brown paper or in news paper and kept in an electric hot air oven for sterilization at 160-180°C for 3-4 hours and medias sterilized in autoclave at 15lb pound pressure at 121°C and open only in laminar flow. Laminar flow was sterilized with the help of U-V light for 30 minutes at room temperature. All necessary precaution was taken to avoid contamination from outside. The analysis was carried out according to the procedure given in APHA (1992).

RESULTS AND DISCUSSION

By performing sensory evaluation it was obtained that sample 04 got the highest overall acceptability of 29 out of 36 while sample 02 and sample 03 got 27 and 25.5 respectively. Sample 04 had 30% orange juice, 15% sugar and 55% whey. Sample 02 and 03 has higher quality of whey and lower in orange juice. These differences might be the reasons behind more acceptability of sample 04. So the final product developed contained 30% orange juice, 15% sugar and 55% whey.Ascorbic acid content of product developed of whey based orange beverages were determined in order to compare the relative amount of ascorbic acid among them. The analysis gave that sample 04 contained much higher amount of ascorbic acid than the other samples such as sample 02 and sample 03.

Sample taken	Ascorbic acid content (mg/100gm)
02	0.142
03	0.67
04	1.78

Table no. 2: Comparative analysis of ascorbic acid content of whey based orange beverages.

The total soluble solid in the newly developed whey based orange beverages were found to be 18°B which is in the range of RTS beverage. The pH of the final product was 4.7. The total acidity of the whey based orange beverage was found to be 1.52%.This low acidity hindrance the growth of micro-

organisms.

Microbial Analysis: It was found out that total plate count of the product was nil. The reasons might be due to hot packaging, pasteurized at 90°C for 25minutes and other aseptic conditions, etc. More over the test was performed at the first day of the development. Yeast and mould count was also found to be negligible. The reasons might be same as in case of total bacteria count. So, after analyzing various physical, chemical and microbial attributes, a list of various properties of the product are given in table no.3.

Sl No.	Attributes tested	Amount
1	Ascorbic acid	1.78mg
2	pH	4.7
3	Acidity	1.52%
4	Total solid	18°Brix
5	Microbes	Nil

Table no.3: Various properties of whey based orange beverage.

Cost analysis of whey based orange beverage

The cost analysis of whey based orange beverage was carried out considering an amount of 200g. The total price of the ingredients used while preparing 200g of whey based orange beverage was Rs.11.8. The cost price was found to be Rs.14.16. The sale price was found to be Rs.16.99/200g.

CONCLUSION

Another aspect of the production was the availability of raw materials. Paneer whey, orange and sugar are found abundantly in Manipur and almost around the year. They are very cheap too. After careful development of the whey based orange beverage, its physical, chemical and microbial analysis was performed. Good and positive results were obtained. Optimization of ingredients was done as listed in table no.5. Sensory evaluations got very high score of 29 out of 36 for sample 04 were amount of sugar was15% against whey was 55%.

Other analysis:

1. The amount of ascorbic acid present in the final product was 1.78%.
2. No micro organisms were found in the product due to hot filling and proper pasteurization.
3. The acidity of the product was found to be 1.52%.
4. The pH of the product was found to be 4.7.
5. Cost analysis showed that the product could be very profitable after commercialization. Price of the product was Rs.11.8 while sale price was Rs. 16.00.

So, after keeping all the results in mind, it can be concluded that an all new whey based orange beverage which is highly nutritive, medicinally valuable and totally harmless have been successfully developed through this project. The product can be commercialized.

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Journal of Natural Resource and Development 13 (1) 110-113, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

TO STUDY THE DIFFERENT SEASONAL EFFECT OF VITAMIN AND MINERAL SUPPLEMENTATION ON MILK PRODUCTION AND REPRODUCTIVE PERFORMANCE OF BUFFALOES IN CHAKA BLOCK, DISTRICT ALLAHABAD

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Received : 18.01.2018 Accepted : 15.03.2018

ABSTRACT

The study evaluated effect of oral vitamin and mineral supplementation on productive and reproductive performance of lactation buffaloes during different season. The buffalo were divided into two uniform groups of 12 each on the basis of farmers practice (T1) and Recommended practice (T2) groups. After calving all (T2) group buffaloes were dewormed with Oxyclozanide and levamisol HCl and supplemented with calcium and phosphorus (100ml/day/buffalo) and chelated mineral mixture (50gm/day/buffalo) for four month (120 days). The overall increase in milk production in (T2) group was 35.46, 29.28, and 41.15, Percent in rainy, winter and summer season respectively, as compared to T1 group. The conception rate was higher in winter season and lesser during rainy and summer season in both groups, while overall conception rate was high in T2 group, as compared to T1 group. The study demonstrates beneficial effect of oral supplementation of minerals and vitamins on production and reproduction potential in lactation buffaloes.

Key words : *Buffalo; milk production; mineral; supplementation; vitamin.*

INTRODUCTION

Daily animals frequently encounter nutritional deficiency due to high production and deficient feeding ultimately, leading to poor reproductive performance. Micro minerals and vitamins are essential part of animals ration and required in minute amount. Mineral and vitamin deficiencies and imbalances cause metabolic disturbances and deficiency diseases. Fertility and calving rate can be adversely affected. Milk production is obviously dependent on health and wellbeing.(Kumar et al., 2011)

Buffaloes are seasonal breeders and susceptible to heat stress affecting feed intake and in turn the nutritional balance inhibiting

productive and reproductive efficiency.

MATERIALS AND METHODS

The present study was conducted under on farm trials (OFT) under field condition for assessment and refinement of technologies. The trials were conducted on newly calved lactation buffalo herds from adopted villages in rainy (July- October), winter (November-February) and summer (March – June) seasons from during 2016-2017.

The study was conducted on 24 lactation buffaloes in each season which were divided into two uniform groups of 12 each, on the basis of Farmers practice (T1) and recommended practice (T2) groups. After calving, all T2 group buffaloes were dewormed with Tolzan plus- L (Oxyclozanide and levamisol 90ml orally) Ascal gold chelated (100ml/day/buffalo) and Ayumin V5 (50gm/day/buffalo) foe a period of four months (120 days). The animals in T1 group which received diet without any supplementation served as controls. The average individual milk production (twice daily and monthly) and reproduction data (0ccurrence of oestrus and conceptions) were recorded in both T1 and T2 group during different seasons through a well structured pretested proforma. The tabular analysis and percentage were used to analyze the data and compared between the groups.

RESULT AND DISCUSSION

The result of the study was presented in two parts: 1) seasonal milk production and 2) seasonal reproductive performance of buffaloes.

1) Seasonal milk production of buffaloes: The milk yield was recorded twice daily (morning and evening) for four months each in three different seasons. The average milk yield/ day/buffalo are presented in Table 1.

The overall average milk production in T1 group of buffaloes was 7.81 liter, 8.64 liter and 7.07 liter in rainy, winter and summer season respectively. In the T2 group, average milk production was 10.58 liter in rainy season, 11.17 liter in winter and 9.98 liter in summer season. The result reveal that in both groups, highest milk production was in winter season as compared to rainy and summer seasons. The present study also revealed that oral feed supplementation with minerals and vitamin in T2 group of animals resulted in an increased overall milk yield (liters/days/ buffalo), as well as percentage of milk yield in all seasons, as compared to those of control animals. In rainy season, the increase was 35.46% winter and summer season, increase was 29.28% and 41.15% percent respectively. It is however, interesting to note that maximum

Table - 1 : Seasonal and Monthly average Milk Production of Buffalo after giving Vitamin and Mineral Supplement

season	No. of lactation bffaloes		Average milk production after supplementation (liters/days/buffalo)								Milk production (liter/day/buffalo)		
			1st month		2nd month		3rd month		4th month		overall		Variation
	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2	
Rainy (Jul-oct.)	12	12	6.90	8.65	7.01	10.50	8.8	11.85	8.45	11.35	7.81	10.58	2.77 (35.46%)
Winter (nov-feb)	12	12	7.50	8.85	8.59	10.88	9.15	12.85	9.35	12.12	8.64	11.17	2.53 (29.28%)
Summer (mar-jun)	12	12	6.30	8.80	7.00	9.42	7.80	10.50	7.20	11.20	7.07	9.98	2.91 (41.15%)
Total	36	36	6.9	8.7	7.58	10.2	8.61	11.73	8.33	11.55	7.84	10.57	2.73 (34.82%)

percent increase was observed in summer season followed by rainy and winter seasons. This clearly indicates the ameliorative efficacy of mineral and vitamin supplementation on heat stress. The present results are comparable with earlier studies under field condition by Gosh and Chatterjee (2001), Singh and Singh (2006) and Singh and Pachauri (2011).

2) Seasonal reproductive performance of buffaloes: Buffalo is a seasonal breeder and hence timely conception after calving is one the most important factors for economic buffalo farming in the present study, observation on reproductive performance are shown in Table .2.

The result reveal that large number of animals came into oestrus in T2 group as compared to T1 group in all seasons, the maximum percent being in rainy (83%) and winter seasons (91%), followed by summer season (75%). Similarly, percent conception in buffaloes in T2 group was maximum in all seasons as compared to those of group T1. The conception rate in group T2 in rainy seasons was 75% as against 33% in group T1, which it was 83 and 41% in winter seasons in group T2 and T1 respectively. Similarly, conception rate in summer seasons was maximum (66%) in T2 group, as compared to T1 group (16%). The overall conception rate was higher in T2 group (74%), as compared to T1 group (30%). The better reproductive performance in winter seasons is obviously because of cool environmental temperature which is most favorable for buffalo breeding and conception. The less number of animals in oestrus and low percent of conception in T1 group during summer seasons could be due to influence of heat stress, as well as non –availability of quality green fodder in sufficient amount. The enhanced reproductive performance of lactating buffaloes in T2 group in all seasons clearly reveals beneficial effect of mineral and vitamin supplementation. Similar finding have been reported earlier by Samanta et al. (2005), Singh and Pachauri (2011) and Behera et al. (2012). The enhance percent conception in group T2 buffaloes, supplemented with mineral and vitamin, could be due to higher percentage of buffaloes coming into heat (83%) as compared to buffaloes in T1 groups (47%). Substantially higher number of buffaloes of T2 group in oestrus and consequent conception, as compared to those of controls during summer seasons could be attributed to ameliorative effect of mineral and vitamin supplementation against heat stress.

Table - 2 : Seasonal and Monthly Reproductive Performance of Buffaloes after giving Vitamin and Mineral Supplement

Seasons	No. of buffaloes		No. of animals in oestrus		No. of animals conceived	
	T_1	T_2	T_1	T_2	T_1	T_2
Rainy (July- October)	12	12	6 (50%)	10 (83%)	4 (33%)	9 (75%)
Winter (Nov- Feb)	12	12	7 (58%)	11 (91%)	5 (41%)	10 (83%)
Summer (march-June)	12	12	4 (33%)	9 (75%)	2 (16%)	8 (66%)
Total	36	36	17 (47%)	30 (83%)	11 (30%)	27 (74%)

CONCLUSION

The present study concludes that oral supplementation of mineral and vitamins in from of Ascal goal chelated and Ayumin V5 plays an important role in enhancing the productive and reproductive performance of lactation buffaloes in all seasons. Interestingly, supplementation was most effective in amelioration of heat stress result in better milk yield and reproductive performance during the summer seasons. On basis of present study, it can be recommended that buffalo keepers should regularly supplement animals with chelated mineral and vitamins products in sufficient among. During summer seasons to achieve better production and reproduction, so that their economic position can be improved to considerable extent. Similar conclusion have been reported Satyendra Pal Singh (2014).

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Journal of Natural Resource and Development 13 (1) 114-119, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

INFLUENCE OF INTERCROPPING ON ROOT-GALL NEMATODE DISEASE ON OKRA (ABELMOSCHUS ESCULENTUS L.)

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Received : 11.04.2018 Accepted : 15.05.2018

ABSTRACT

Six intercrops (maize, water melon, soybean, bitter gourd , Amaranthus and red pepper) were tested for control of root-gall nematode disease on okra in a loamy sand soil naturally infested with Meloidogyne javanica. The experiment was laid out in a randomized complete block design replicated four times. Results based on root-gall indices and number of juveniles (J2) recovered from roots and rhizospheric soil showed that intercropping of soybean, red pepper and Amaranthus effectively suppressed infection on okra roots. Soybean, maize, bitter gourd and water melon, intercropped with the okra aggravated root-gall damage and caused yield reduction.

Key words : *Disease, intercrop, nematode, root-gall, okra.*

INTRODUCTION

Okra is the good source of dietary plant fibre with low sugar (Judd, 1970). It produces good yield of pod per unit land area and has the ability to succeed on nearly all soils (Perman, 1982). The crop is usually grown sole and suffers a great deal of nematode damage which has led to some farmlands being abandoned to some parasitic nematodes (Lehman, 1978). Total crop failure in soils heavily infested with root-gall nematode (Meloidogyne spp) has also been reported (Agu, 2006). A number of control methods and practices have however, been developed. These included: inclusion of non-hosts in rotation sequence (Adesiyan et al, 2000), introduction of resistant varieties (Odihirin, 1981); heat and chemical treatments (Adesiyan et al, 2000); use of biological control agents (Adesiyan, 1985) and the use of organic manures (Egunjobi and Onayemi, 1981 and Amosu, 1981). The success and adoption of any one of these methods however depends mainly on the level of expertise and socio-economic conditions of the farmers.

In India, root crops, cereals, legumes and vegetables are grown together in mixtures in various combinations. Besides yield advantages (Wahua et al, 1981) mixed cropping

systems also provide an effective strategy in controlling nematode pests of agricultural crops (Idowu and Fawole, 1991). This is by intercropping a susceptible crop with non-host crops. Information on crop mixtures for effective control of okra root-gall nematode is lacking. This study was therefore concerned with the evaluation of different soybean based intercrops for effective control of root-gall nematode disease on okra

MATERIALS AND METHODS

The study was conducted at the Department of Horticulture, Kulbhasker Ashram Post Graduate College, Allahabad in the year 2015-16. The soil was loamy sand and naturally infested with root-gall nematode, Meloidogyne javanica. By sieving and Bearmann's funnel technique (Viglierchio and Schmitt, 1983), the nematode population density in the soil was estimated.

Before planting, the land was cleared and made into mounds (2 x 1 m) according to farmers' practice and laid out in a randomized complete block design with four replications on a 20 x 25 m plot size. Okra cv Pusa Sawani, moderately susceptible to M. javanica (Awolola, 1987); Soybean; Water Melon cv Madhu , Bitter gourd cv Small Green; Maize cv. Deccan; Red pepper cv. Jwala and Amaranthus cv. Harit Local were combined as follows: okra/ water melon/maize/okra; okra / maize / okra / Amaranthus;okra / red pepper / water melon / Amaranthus; okra / water melon / Amaranthus / red pepper; okra / water melon / maize /bitter gourd melon; okra / pepper / water melon / okra and interplanted the same day on the mounds using the sole populations of each (okra, 50,000; soybean, 2,40,000; water melon, 10,000; bitter gourd , 10,000; maize, 20,000; red pepper, 17,778 and Amaranthus, 222,222 / ha, (Unanma et al, 1991). In each crop mixture, okra was sown one seeds / hole on crest and the intercrops planted 15 cm away from okra and in alternate arrangement. Mounds planted with sole okra served as control.

Compound fertilizer NPK 15:15:15 at 400 kg/ha was applied after first hoe-weeding (i.e. 3 weeks after planting) and second weeding done 10 weeks after planting. Twelve weeks after planting the crops were carefully lifted from soil and the crops separately washed free. The roots were examined and rated for galls on a scale of 0 to 4 according to Ogubji (1981) in which 0 = no infection (no galls present); 1 = rare infection (1 – 3 galls present); 2 = light infection (4 – 10 galls present); 3 = moderate infection (11 – 30 galls present) and 4 = severe infection (≥ 30 galls present). Juveniles second stage (J2)/2 g of plant root system were extracted by the jar incubation method (Ayoub, 1977). Juveniles/120 cm3 of soil were also extracted using a modified Bearman funnel technique (Tray method) (Hooper, 1969). The nematodes from roots and soil were counted using a dissecting microscope.

Data collected on okra also included: number of harvested pods/plant, number of grains/pod; shoot weights (fresh and dry); grain yield/ha and root dry weights. These data were subjected to analysis of variance (Steel and Torrie, 1981) and significant differences between means separated by Fisher's least significant difference method (Fisher, 1948) at P = 0.05.

RESULTS AND DISCUSSION

Crops roots rated for galls showed that the intercrops differed in host status to M. javanica (Table 1) and can be grouped as follows: (i) highly susceptible: soybean water melon, bitter gourd; (ii) moderately susceptible: maize ; (iii) moderately resistant: red pepper and (iv) highly resistant: Amaranthus. The intercrops influenced root-galling on okra (Table 2). Severe root-galls occurred on okra plants intercropped with soybean, maize and

melon; also with bitter gourd, melon and maize as well as with maize, soybean and Amaranthus. Moderate root-galls occurred on the okra when intercropped with melon, Amaranthus and pepper. Pepper, Amaranthus and bitter gourd intercrops suppressed gall formation on the okra.

These results showed thatsoybean, maize and melon are not good crop associates with okra in M. javanica infested soils. This observation agrees with Bridge (1978) who noted that planting susceptible crops alongside yam plants could increase nematode population density and the severity of damage by root-gall nematode (M. incognita) on yam plants. Atu and Ogbuji (1986) also reported that susceptible intercrops planted on yam mounds resulted in greater root-gall damage on the harvested tubers.

Rare root-galls on okra caused by

Table 1 : Host status of intercrops collected from around M. javanica infected okra.

Sl.No.	Intercrop	Mean okra root gall indices (0-4)	Host status to *M. javanica*
1.	Soybean	3.90	Highly susceptible
2.	Water melon cv. Madhu	3.10	Highly susceptible
3.	Bitter gourd cv. Small Green	3.10	Highly susceptible
4.	Maize cv. Deccan	2.90	Moderately susceptible
5.	Red pepper cv. Jwala	1.52	Moderately resistant
6.	Amaranthus cv.Harit Local	0.23	Highly resistant
7.	LSD 0.05	1.00	

Table 2 : Root gall indices , Number of M. Javanica juvenile (J2) recovered from roots and rhizopheric soil of okra alone and in association with other intercrops.

Sl.No.	Crop mixture	Mean okra root gall indices (0-4)	Juvenile population (J_2) Per 2 g root system	Juvenile population (J_2) per 200 cm3 soil
1.	O/RP/BG/A	0.40	12.01	42.02
2.	O/RP/BG/S	2.20	45.02	54.25
3.	O/WM/A/RP	3.00	145.06	124.41
4.	O/BG/M/WM	3.63	206.23	245.01
5.	O/M/S/A	3.63	306.86	234.20
6.	O/WM/M/S	3.63	325.63	321.02
7.	Okra (control)	2.02	155.02	120.11
8.	LSD $_{0.05}$	1.02	54.02	62.36

S=Soybean, RP= Red pepper, BG=Bitter gourd, A=Amaranthus, O= Okra, M=Maize, WM= Water melon.

Table 3 : Okra yield as affected by intercrops and root gall nematode infection .

Sl.No.	Crop mixture	Mean okra root gall indices (0-4)	Pods/plant (No.)	Seeds/pod (No.)	Grain yield (t/ha.)	Shoot fresh weight (g)	Shoot dry weight (g)	Root dry weight (g)
1.	O/RP/BG/A	0.40	21.22	3.56	3.75	10.12	3.01	9.17
2.	O/RP/BG/S	2.20	15.27	3.65	2.89	10.01	3.85	10.24
3.	O/WM/A/RP	3.00	13.56	2.89	2.56	9.23	3.60	13.80
4.	O/BG/M/WM	3.63	10.74	2.16	4.53	8.78	4.63	16.15
5.	O/M/S/A	3.63	9.62	2.72	4.72	8.62	4.72	15.89
6.	O/WM/M/S	3.63	10.65	1.26	6.59	8.72	6.89	18.12
7.	$LSD_{0.05}$	1.02	3.95	1.56	2.08	0.52	2.03	3.45

resistant red pepper and Amaranthus and intercrops was because these intercrops prevented nematode population increase around the okra plants (Table 2). Fawole and Mai (1979) reported that gall indices corresponded with nematode population density.

Okra yields varied with galling responses at different crop mixtures (Table 3). Significantly higher number of pods/plant were produced by okra plants intercropped with red pepper, Amaranthus and bitter gourd with low gall index. Grain yield (tons/ha), fresh shoot weight and number of grains/pod consistently decreased with increases in galling response at the various crop mixtures. These decreases were significant on okra plants intercropped with two or more of the intercrops susceptible to the root-gall nematode (M. javanica). This was due to significant increases in galling response at significantly increased nematode population attacking the okra (Table 2). Galls are known to decrease the uptake of minerals, especially, N, P and K (Trudgill, 1987) and also do not translocate adequate water and nutrients to vegetative organs for photosynthesis (Otiefa and Elgindi, 1962).

Okra root dry weights increased as galling response increased with increasing number of intercrops susceptible to the root-gall nematode (Table 3). This was because of the weight gain on the main roots caused by galls. Agu (2002) found that galled roots represented most of the total weight of the root system.

From this study, it is obvious that root-gall nematode disease on okra can be effectively controlled and good grain yields obtained in M. javanica infested soils if bitter gourd , red pepper and Amaranthus were used as intercrops. Bitter gourd , pepper and Amaranthus are therefore recommended as intercrops for effective control of okra root-gall nematode disease in soils infested with M. javanica.

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Journal of Natural Resource and Development 13 (1) 120-126, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

A STUDY ON IMPACT OF SELF HELP GROUP ON LIVELIHOOD OF RURAL TRIBAL WOMEN IN EAST SIANG DISTRICT OF ARUNACHAL PRADESH

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Received : 10.02.2018 Accepted : 15.04.2018

ABSTRACT

The study was carried out with rural women of Adi and Galo tribes of East Siang district, Arunachal Pradesh, associated with self-help groups (SHGs) for understanding the prospect and bottle neck in their functioning. A random sample of 50 members from self-help groups (SHGs) associated with ATMA, Pasighat, East Siang, Arunachal Pradesh were evaluated. The study revealed that maximum changes (84%) occurred in awareness on household maintenance and cleanliness. Further, measurable changes have been observed in knowledge in agriculture and allied activities as well as habit of money saving (82%). Self Help Group in Arunachal Pradesh played an important role in development of agriculture and allied sector, agro-processing, marketing and handicraft sectors. SHGs have a role in poverty alleviation, food security and employment generation is well established. The major constrain faced by tribal women members of SHGs (76 % and 78%) was marketing of farm produce and availability of input for different activities, respectively.

Key words : *Self-help group; household; agriculture; poverty; marketing, livelihood.*

INTRODUCTION

East Siang district of Arunachal Pradesh is located between 27.300° to 29.420° North latitude and 94.420° to 95.350° East longitude with a total population of 99,214 with a population density of 27 inhabitants per square kilometer according to the 2011 census. Poverty, inadequate and unreliable infrastructure, poor communication and weak institutional support as well as climate change are adversely affecting farmers' livelihoods. The major income source of the tribal population in

the district is agriculture and allied activities and women are part and partial of all the activities and also have an important role in livelihoods of the family. In the recent past due to unawareness and lack of structured approach the women of the state are lacking financial as well as intellectual growth. In this context formation of women welfare groups may serve as boon to the society as half of the population is women. Self-Help Group or in-short SHGs is now a well-known concept where a group of people with collective responsibilities and thoughts for the development of needy, especially under privileged. Self-help groups (SHGs) play today a major role in poverty alleviation in rural area. SHGs are taking part in the development of agriculture and allied sector, agro-processing, storage, marketing etc. SHGs have inherent advantages in tackling the problems of poverty alleviation, food security and employment generation. Mainly, members of the SHGs are women for generating self-employment opportunities at grassroots. The SHG promotes small savings among its members. The origin of Self Help Groups (SHGs) is the brainchild of Grameen Bank of Bangladesh, founded by Prof. Mohammed Yunus in 1975, who tried out a new approach to rural credit in Bangladesh. Grameen gave loans without asking borrowers either to provide collateral or engage in paper work. In India, NABARD initiated SHGs in the year 1986-87 but the real effort was taken after 1991-92 from the linkage of SHGs with the banks. It now addresses the issues of poverty alleviation and empowerment of poor especially rural women in health, nutrition and other support services. SHGs in some parts of India like Andhra Pradesh, Tamil Nadu etc have miraculous achievements in addressing various societal problems. Arunachal being one of the strategically important and a relatively backward state needs SHG revolution. There are around 4500 SHGs and the savings amount of Self Help Groups with banks in Arunachal Pradesh was Rs. 256 lakhs as on 31st March, 2015. The present status, challenges and prospects of SHGs in East Siang District of Arunachal Pradesh is not known clearly, keeping it in view an effort has been made to study the impact of Self Help Group on Livelihood of Rural Tribal Women in East Siang District of Arunachal Pradesh with the following objective.

a. To examine the role of SHG in developing socio economic status of rural women.
b. Perception in different aspects after joining SHG.
c. To identify the problems faced by the members of SHGs.

MATERIALS AND METHODS

The study was conducted by Krishi Vigyan Kendra East Siang in collaboration with Department of Social Sciences, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh in East Siang district of Arunachal Pradesh. A list of all the self-help groups (SHGs) functioning under the guidance of ATMA East Siang was obtained from the Deputy Director Agriculture (Training), ATMA, Pasighat, East Siang (Table-1). Out of this list 10 SHGs were randomly selected for the study. A list of all the members existing in the selected SHGs was prepared. A random sample of 50 SHG members was taken for the collection of required information for the study. Primary data were collected from the SHG members through personal interview method with the help of a well structured and pre-tested schedule. In order to collect the necessary data, both descriptive and exploratory methods were adopted. Further, focused group discussions (FGD), personal observation techniques etc were used to unearth all the possible information on the

characteristics of group and qualitative information on the behavior of the SHG members and also to understand the level of enthusiasm, group participation, decisiveness and cooperativeness among the members.

RESULTS AND DISCUSSION

General characteristics regarding age, marital status, educational qualification, family type, caste etc. of the randomly selected respondent of self help group are presented in Table 2. It was observed that majority of the self help group members (64%) belongs to age group of middle age i.e. 36-50 where as only 28 % rural tribal women belonged to the category of young age (18-35 years) indicating that the middle aged married women have more family responsibilities and have desire to change for individual as well as family welfare. Sandhu (2015) opined that women are the most preponderant segment of the rural society, regarded as the unsung heroine who works from dawn to dusk but long been bypassed or overlooked in the process of empowerment. In our study it was revealed that middle aged women were also in a position to take decisions at home as compared to younger counter parts and were also more efficient and responsible. Similar type of observation also has been made by Joseph and Easwaran (2006). Participation of married women in Self Help Group is higher (88%) as compared to unmarried women i.e. only 12 %. Saravanan (2016) opined that self help group is an important tool which helps the rural women to acquire power for their self-supportive life. In perspective to education standard is observed that 68% of tribal women were studied up to primary level whereas only 8 % women were illiterate. In context to family type, it is observed that majority of the women (72 %) belongs to nuclear family and 28 % women belonged to joint families. Cent percent of the respondent belonged to ST category from Adi and Galo tribes.

In the survey on the changes in the perception in different aspects after joining SHG by tribal women (Table 3), it was observed that maximum changes (84%) occurred in awareness on household maintenance and cleanliness whereas meager improvement in status of the women in family (22%) has been observed. Further, measurable changes have been observed in knowledge in agriculture and allied activities as well as habit of money saving (82%). The results were in line with the study by Husain and Nair, 2006 that SHG's provides a platform for rural women for obtaining skill development training in order to generate both income as well as employment opportunities. Despite of desire for savings they are unable to improve their financial status, it may be due to the problem of marketing of processed product (56%) and farm produce (76%) as well as availability of inputs for different activities (78%). The low level of influence of fluctuating bank policies on farm women revealed that the tribal women were reluctant in risk taking activities. The major constrain faced by tribal women members of SHGs (76 % and 78%) was marketing of farm produce and availability of input for different activities, respectively. 66% women felt that there was lack of cooperation among members within the group due to one or other reason. Similar type of observation was reported by Sharma and Chand (2014) that lack of cooperation among the members of the group, family elders do not permit female members to go outside the home and groupism among the members of the group adversely affect the effective functioning of SHGs. In our study only 8 % women reported lack of family cooperation. All these problems were mainly due to lack of awareness, education and exposure as well a remote location to the villages.

Table 1: List of self-help groups (SHGs) functioning under the guidance of ATMA, East Siang, Arunachal Pradesh and their activities.

Sl. No.	Name of the SHG	Village	No. of Members	Major activities of the group
1.	SHG Koje Raseng	Sigar	16	Agriculture and allied activities and house hold processing of agricultural produce.
2.	Kado Party Self Help Group	Namsing	10	Processing of agricultural produce, weaving and making of tradition dresses.
3.	Kigong Lunggong SHG	Takilalung	16	Agriculture and allied activities.
4.	Karpung Raseng Group	Yapgo	08	Handicraft and Making of tradition dresses.
5.	JNC Self Help Mingkeng Group	JNC area	13	Processing of agricultural produce.
6.	Nyanyi Mete SHG	Ngorlung	10	Involved in rubber cultivation, making of tradition dresses.
7.	Ute Poro SHG	Ngorlung	10	Processing of agricultural produce.
8.	Kai Ane Self Help Group	JNC area	08	Processing of agricultural produce.
9.	Milik Kalik SHG	Ayeng	08	Preparation of tradition food items, vegetable farming.
10.	Koje Tanggo SHG	Ayeng	14	Handicraft and Making of tradition dresses.
11.	Ane Ravi SHG	Ayeng	14	Agriculture and allied activities and house hold processing of agricultural produce.
12.	Mibang Ayeng SHG	Ayeng	14	Processing of agricultural produce.
13.	Angum Bedang SHG	Napit	04	Agriculture and allied activities and house hold processing of agricultural produce.
14.	Agam SHG	Ngopok	08	Tradition food preparation, Handicraft and Making of tradition dresses.
15.	Arsang Ane SHG	Sera	10	Processing of agricultural produce, weaving of tradition dresses.
16.	Tel cream SHG	Mebo	11	Processing of agricultural produce.
17.	Arsang Mobong SHG	Silluk	09	Handicraft and making of tradition dresses.
18.	Siang Mushroom Group SHG	Mirbuk	10	House hold processing of agricultural produce, mushroom cultivation.
19.	Mirsam Mingkeng Ane Group	Mirsam	7	Floriculture activities, house hold food processing activities.

Table 2: General characteristics of the respondents (N =50) randomly selected for study

Variables	Category	No.	%
Age	Young (18-35 years)	14	28
	Middle (36-50 years)	32	64
	Old (Above 50)	04	08
Marital Status	Married	43	86
	Unmarried	06	12
	Widow	01	02
Educational qualification	Illiterate	04	08
	Primary education (1-4)	34	68
	Middle	04	08
	Matriculation /10+2 and College	08	16
Family type	Joint Family	14	28
	Nuclear family	36	72
Caste	SC/ST	50	100
	Others	-	-

Table 3 Perception in different aspects after joining SHG (N = 50) randomly selected for study.

Factors	No.	%
Improvement in financial status	16	32
Improved self confidence level	30	60
Improved social status	28	56
Improved status in family	11	22
Involvement of women in decision making in family	31	62
Helps in Family Finance	12	24
Promote Saving Habit	41	82
Obtain Financial Support	08	16
Improvement of knowledge in agriculture and allied activities	41	82
Desire to start income generating activity	40	80
House hold maintenance and cleanliness	42	84
Knowledge in nutrition and house hold processing	38	76
Skill development in handicraft	26	52

Table 4: Constraints faced by members of SHGs selected for study (N=50).

Constraints	No.	%
Family elders' reluctance in permitting female members to go outside the home	4	8
Fluctuating bank policies often affect the functioning of SHG	-	-
Groupism among the members of the group	3	6
Sometimes, there is lack of co-operation among the members, thus, adversely affecting the functioning of the group	33	66
Availing benefit by taking loan from Bank	-	-
Marketing of processed products	28	56
Effect of flood and erratic rainfall	14	28
Incidence of insect pest and diseases in crops	12	24
Marketing of farm produce	38	76
Availability of input for different activities	39	78

CONCLUSION

Self-help groups are formed with an objective to enhance profitability for rural people especially rural women. It is an imperative approach which helps the rural women to acquire supremacy for their self-supportive life. SHGs clearly play a vital role in the lives of the rural poor families. In tribal society, women have the responsibilities of caring for household which involves cooking, cleaning, fetching water and fuel, collecting fodder for the cattle, protecting the environment and providing voluntary assistance in different village functions. In the present study major changes were observed in awareness on house hold maintenance and cleanliness, knowledge in agriculture and allied activities as well as habit of money saving. Active participant of rural tribal women were belongs to nuclear family type. Empowering women is not just for meeting their economic needs but also more holistic social development. Though the rural women from East Siang district, Arunachal Pradesh acquired habit of money saving, however it was observed that none of the SHG involved in the present study did not tried to avail loan from any bank as well as they were not getting benefit of schemes initiated for the welfare of rural women. In this context it is need of the hour to focus by the extension personal to organize various awareness and interaction programme with the SHGs for wide publicity about the government schemes. The social impact of the SHG programs increased the involvement of women in decision-making; awareness about various programs and organizations encourages the rural women to participate in different developmental programme of the government. One of the most important benefits of involving rural women in a SHG is the acquiring regular saving habits and access to formal savings.

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Journal of Natural Resource and Development 13 (1) 127-133, 2018 | NAAS RATING : 3.46 | ISSN-0974-5033

USE OF E-CHOUPAL FOR INFORMATION AND DEVELOPMENT OF RURAL COMMUNITY IN DISTRICT ALLAHABAD (U.P.)

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Received : 10.01.2018 Accepted : 15.02.2018

ABSTRACT

E-Choupal is one among the numerous private ICT initiatives, started in the year 2000. It acts both as a social gathering place and e-commerce hub. This new world order where information is at the center stage, farmers need to make precise and crucial decision in a minimum time not only in a view point of production but also for marketing of produce. The study was conducted in Allahabad district of Uttar Pradesh. Two blocks i.e. Karchana and Meja were purposively selected as e-Chaupal is running in these blocks. Three villages from each block were selected randomly and out of each selected village ten E-choupal user and ten non users were randomly selected for final data collection. Data were gathered through pre-coded interview schedule. The access was measured on the five point scale developed by Likert(1934) with necessary modification developed as always, most often, often, less often, and not at all and the scores assigned were 4,3,2,1 and 0 respectively. An index was developed using the formula given below: Among all the services provided by e-choupal the services, of market price information was widely used by the farmers. Above eighty per cent of farmers used that service 'Always' before selling their produce. A high level of overall satisfaction towards the use of e-choupal services was felt by 50.00 per cent of farmers.

Key words : *Extension, e-Choupal, marketing, communication, sanchalaks,* produce.

INTRODUCTION

❖ Information Technology is a component of the electronic age that has stifled the communication barrier to a great extent. Communication is a pivotal pillar for development to take place. IT acts as an important tool to bridge the communication gap, especially in the rural areas.

❖ In the year 2000 when ITC (formerly known as the Indian Tobacco Company Ltd.) launched E-Choupal in the Indian states of Uttar Pradesh, Madhya Pradesh, Rajasthan and Maharashtra.

❖ As part of the e-choupal program it has set up approximately 6500 internet kiosks in over 40,000 villages to enable farmers to retrieve marketing and agricultural information right at their doorway. E-choupal creates a 'virtual market place' where farmers can directly sell their produce just by a click of a mouse as all forms of information are made accessible to the farmers regarding seeds, fertilizers, pesticides, weather conditions, farming techniques, etc. They can compare, bargain and select the listed price.

❖ It facilitates greater proportion of profit for the farmers as the number of intermediaries is reduced to a great extent. It also promotes participation of the rural people by involving people in developing content of the web; channelize the information as per the needs of the people with a quicker and more flexible mode of transaction.

❖ The functioning of e-choupal involves a'Sanchalak' who is as local villager whose prosperity is interlinked with that of the fellow farmers and of the companies like ITC. The Sanchalak is trained and sensitized for this purpose. The sanchalak get a commission for every transaction they process, thereby creating a healthy earning atmosphere for all.

MATERIALS AND METHODS

Multistage Purposive random sampling technique was adopted to carry out the research. District Allahabad was purposively selected and out of 7, two block namely Karchana and meja were also purposively selected as e-Choupal is very well functional in these two blocks. Two villages out of each selected village were randomly selected and from each selected village 10 e-Choupal users and 10 non users were randomly selected for final data collection. . Thus total sample comprises of 120. Data were gathered through personal contact by a pre-coded interview Schedule. The access was measured on the five point scale developed by Likert (1934) with necessary modification as always, most often, often, less often, and not at all and the scores assigned were 4,3,2,1 and 0 respectively.

➢ An index was developed using the formula given below :

$$\text{Access to Various Serious Index} = \frac{\text{Score obtained by individual}}{\text{Maximum score (28)}} \text{ X100}$$

RESULTS AND DISCUSSION

Table1 clearly depicts that majority (61.67%) of user belonged middle age group, literate i.e. can read and write only (40.00),from nuclear family(61.67%), and of general category (36.66). whereas, maximum i.e. about sixty seven per cent users were having agriculture as main occupation, small farmers (55.00% and) from low income category means having Rs. Up to 50,000 from all sources. On the other hand Majority (50.00%) non users were also from middle age group, illiterate (53.33%), belonging to nuclear family (65.00%), general caste (43.33%), involved in agriculture (46.66%), fell in small farmer category (48.33%) having annual family income up to 50,000 (56.67%).

Table:2. Envisages that Out of all nine services offered by e-Choupal majority (81.70%) of respondents 'always' access 'market price' therefore identified as Rank I with Mean Score

Table-1: Distribution of Respondents on the basis of Socio-Economic Profile

N= 120

S.No.	Particular	Users		Non-Users	
		Frequency	**Percentage**	**Frequency**	**Percentage**
I	**Age**				
1.	Young (18 to 30)	21	35.00	17	28.33
2.	Middle (31-50)	28	46.67	30	50.00
3.	Old (50& above)	11	18.33	13	21.67
	Total	**60**	**100**	**60**	**100**
II	**Education**				
1.	Illiterate	10	13.33	32	53.33
2.	Literate (can read and write)	21	40.00	7	11.67
3.	Primary School	4	5	5	8.33
4.	High School	14	20	6	10.00
5.	Inter mediate	6	10	7	11.67
6.	Graduate and above	5	11.67	3	5.00
	Total	**60**	**100**	**60**	**100**
III	**Type of family**				
1.	Nuclear	37	61.67	39	65.00
2.	Joint	23	38.33	21	35.00
	Total	**60**	**100**	**60**	**100**
IV	**Caste category**				
1.	General	22	36.66	26	43.33
2.	OBC	18	30.00	16	26.67
3.	SC	20	33.34	18	30.00
	Total	60	100	60	100
V	**Occupation**				
1.	Agriculture	40	66.67	28	46.66
2.	Agriculture+ Business	11	18.33	21	35.00
3.	Agriculture+ Service	9	15.00	11	18.34
	Total	**60**	**100**	**60**	**100**
VI	**Land Holders**				
1.	Marginal (Up to 1 ha)	15	25.00	20	33.34
2.	Small (1-2 ha)	33	55.00	29	48.33
3.	Big (above 2 ha)	12	20.00	11	18.3
	Total	**60**	**100**	**60**	**100**

3.82, while about thirty seven per cent respondents 'often' used 'marketing of crops' facility and more than twenty per cent respondents 'not at all' used this service with Mean Score 3.09 and Rank II. 'Latest Best Agriculture practices' was the III most used facility provided by e-Choupal with Mean Score 2.32 but Question-Answer was the least used facility with Mean Score 1.37 Rank IX

It is very clear from the table 3 that 'Plant Protection Measures' was the most used service among all improved agricultural practices suggested/ provided by e-Choupal with Mean Score 2.50 therefore ranked I. In contrast 'Seed Treatment' and Manure & fertilizers are the least accessed services of e-choupal among improved practices with Mean Score 1.75 and 1.70 and Rank V and VI respectively.

Table-2 : Mean Distribution of Respondents on the basis of Extent of Access of Services provided by e-Choupal

S. No.	Services provided by e-choupal	Always	Most often	Often	Less often	Not at all	Mean Score	Rank
1	Market Price	81.70	10.30	-	-	8.00	3.82	I
2	Marketing of crops	6.70	s	36.70	8.30	21.40	3.09	II
3	Latest Best Agricultural practices	5.00	8.30	18.30	38.30	30.00	2.32	III
4	Input Supply	6.70	8.30	15.00	40.00	30.00	2.22	IV
5	E-education	-	5.00	36.70	28.30	30.00	2.17	V
6	Agricultural News	6.70	8.30	8.30	20.00	56.70	1.78	VI
7	Weather Information	1.70	3.30	14.30	20.00	60.70	1.73	VII
8	Entertainment	-	8.30	5.00	21.70	65.00	1.57	VIII
9	Questions- Answers Service	-	-	3.3	30.0	66.7	1.37	IX

Fig-1&2 Overall Extent of Access of Traditional Services and Improved Agricultural Practices

Fig 1and 2 related to over all extent of access of Traditional and improved services provided by e-Choupal clearly states that maximum Medium level of access has been done for traditional services (66.70%) and improved practices (58.30%) as well.

Table 4 reveals very high level of satisfaction was shown by 41.70 per cent respondents with reference to marketing of produce while more than fifty per cent were found highly satisfied. Fifty percent farmers were found medium level satisfied with respect of provision of appropriate technologies while 53.30 and 46.70 per cent respondents were satisfied up to high level for the timeliness of services and miscellaneous services.

CONCLUSION

v Farming today is far different from what was before, even, today farming is seen as an

Table-3 : Mean Distribution of Respondents on the basis of Extent of Access of improved agricultural Practices provided/ Suggested by e-Choupal

S. No.	Services	Always	Most often	Often	Less often	Not at all	Mean Score	Rank
1	Plant protection measures	33.3	23.3	5.0	11.7	26.7	2.50	I
2	Varieties	20.0	30.0	16.6	16.7	16.7	2.20	II
3	Seed rate	20.0	30.0	16.6	16.7	16.7	2.20	II
4	Sowing time	18.3	18.3	11.7	20.0	31.7	1.90	III
5	Weed management	8.3	26.7	16.7	15.0	33.3	1.80	IV
6	Manures &fertilizers	1.7	13.3	20.0	20.0	45.0	1.75	V
7	Seed Treatment	-	8.3	6.7	26.7	58.3	1.70	VI

enterprise wherein farmers need varieties of information for various aspects in this competitive world to secure their livelihood and e-Choupal provides opportunities for accessing different traditional services and improved agricultural practices as well

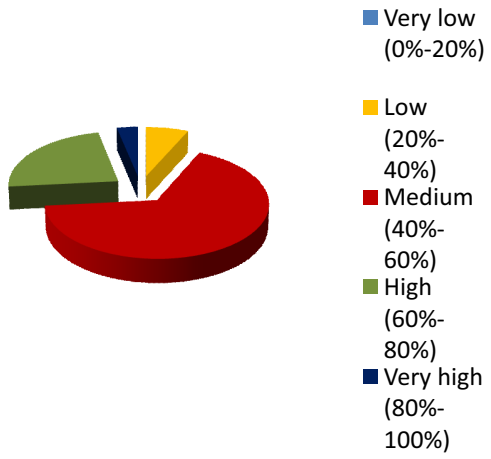

Fig-1;:over all extent of acess of traditional Services

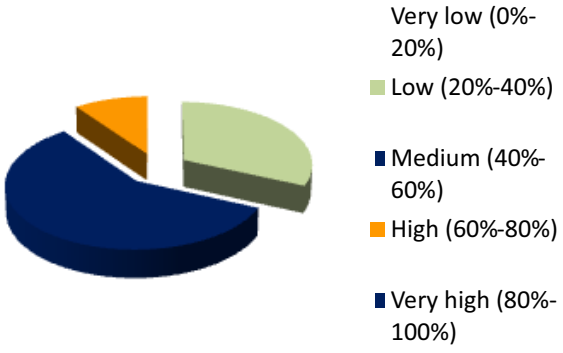

Fig-2: Over all Extent ofaccess of improved agricultural practces

v Majority of respondents access for market price and marketing of crops among traditional services while among improved agricultural practices plant protection measures and varieties were maximum accessed services.

v Medium level of access was done for both the services. Majority of respondents were found highly satisfied for all most all the facilities viz: provision of appropriate technological information, marketing of produce to sanchalaks and timeliness of service

v the satisfaction of user farmer with the

Table -4: Level of overall Satisfaction of Farmers towards the Services of E-Choupal

S.No.	Particulars	Level of satisfaction (per cent respondents)				
		Very high	High	Medium	Low	Very low
1	Satisfaction of farmers towards provision of appropriate technological information	10.00	40.00	50.00	2.50	2.50
2	Satisfaction of farmers towards supply of proper inputs by e-choupal	5.00	3.30	66.70	13.30	11.70
3	Satisfaction of farmers with respect to marketing of produce	41.70	51.70	6.60	-	-
4	Satisfaction of farmers in sanhalaks	26.67	36.60	23.40	13.33	-
5	Satisfaction of farmers in timelines of services	5.0	53.30	26.7	11.7	3.3
6	Satisfaction of farmers in miscellaneous services	1.6	46.70	40.0	11.7	-

marketing facilities arrangement by e-choupal was reflected by the higher profit they could able to get compared to non-users of e-choupal. Even though sanchalaks had some economic motive they could give the generic information without any bias, catering to the need of villagers without any difficulty.

v Suggestion: ICT can play an increasingly important role in linking the research-extension-market continuum towards developing professional competencies and entrepreneurship capabilities among specialists and farming communities respectively so such programmes should be implemented and motivated widely.

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