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Singh, V. and Tulachan, P.M. (2002) A dynamic scenario of livestock and dairy production in Uttaranchal hills. Envis Bulletin: Himalayan Ecology and Development, 10(1): 6-10.

areas were more or less similar. The buffaloes were stall-fed while cattle and other categories of livestock were sent out for grazing during day time. The practice of chaffing of green and dry fodder before feeding was practically absent. The use of complete mineral mixture and compound balanced concentrate mixture was also non-existent. Availability of green fodder in animal ration was higher in rainy season compared to summer and winter season while the availability of dry fodder and tree leaves was higher in winter season. The buffaloes are bred naturally in both the Kumaon and Garhwal regions. In case of cows 85.92% farmers followed natural service, 5.10% A.I., and rest 8.98% both A.I. and natural service. The poor availability of improved bull for natural service or A.I. facilities along with poor and imbalanced nutrition during large part of the year was responsible for delayed maturity leading to higher age at first calving and longer inter calving period. The animals were herded in a poorly ventilated unhygienic and dark house during night. The prophylactic measures, like vaccination, devorming etc. were also uncommon and most of the animals in the area are treated using indigenous preparations. The unhygienic condition in which most of the animals are kept give rise heavy calf mortality and other problems, particularly prolaps of uterus, poor growth and low milk yield etc.

The annual average family income from livestock were estimated to be higher in Kumaon (Rs. 6316) than Garhwal region (Rs. 5472) which was because of larger proportion (53.07%) of farmers were rearing the buffaloes in Garhwal region than Kumaon region. Hence, farmers of Kumaon region may be advised and encouraged to rear the buffaloes to increase their income from livestock production. The annual average family income from livestock production differed among the different categories of size of land holdings and it increased with increase in the size of land holdings. The annual average family income from livestock production also differed significantly among the dirrerent livestock production sub-system in both the regions. It was higher in LPS-1 (Rs. 6793) which was based on buffalo alone in Kumaon region but it was higher under LPS-6 (Rs. 9207), which was based on Buffalo + cow + poultry in Garhwal region. Therefore, LPS-6, the livestock production sub-system, based on Buffalo + cow + poultry should be promoted and advised to the farmers of Kumaon region for increasing the average family income from livestock production.

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DETERMINATION OF NITROGENASE ACTIVITY IN STIGONEMATALES

Kirti Raje Singh
Department of Botany, University of Allahabad, Allahabad - 211002. (U.P.), India

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ABSTRACT

Present communication deals with the Nitrogenase activity of 10 selected strains of Stigonematales. Nitrogenase activity was calculated after 10 and 20 days Growth intervals in nitrogen deficient medium. In the experiment inter-generic variation were observed in available isolate it was found that *Hapalosiphon* showed maximum nitrogenase activity both after 10 and 20 days growth intervals. However minimum nitrogenase activity was observed in *Chlorogloeopsis*-354 after 10 and 20 days growth intervals.

Key Words: Blue green algae, stigonmatales, nitrogenase activity, chlorophyll-a

Nitrogen fixation by blue algae has been studied by (Stewart 1980, Gallon 1980. Blue green algae that fix atmospheric nitrogen play an important role to maintaining the fertility of rice field. This has been well documented by (Singh 1961, Roger and Kulasooriya 1980, and Venkataraman 1981). The chief agricultural and ecological importance of these algae depends on the availability of certain species to carry out both photosynthesis and nitrogen fixation.

In recent times the considerable evidence for the capacity of blue-green algae to fix atmospheric nitrogen has been contributed by (De 1939, Singh 1942, Fogg 1942,). The physiology and biochemistry of nitrogen fixing blue-green algae either exclusively or in a wider context has been well documented by (Fogg and Wolf 1954, Fogg 1956, Stewart *et al*., 1980,). In India the beneficial effect of blue-green algae on rice has been demonstrated in many localities in term of gram yield of many varieties. The distribution and role of nitrogen fixing blue-green algae in temperate region have been investigated in Russia (Gollerbakh and Shtina 1969), Northen and Western Europe (Henriksson *et al*., 1972)

Members of Stigonematales have capacity to fix atmospheric nitrogen this was first time demonstrated by Fogg (1951) in *Mastigocladus laminosus.* It was isolated from hot spring in England. The occurrence of nitrogen fixing Stigonematalean genera such as *Hapalosiphon*, *Westiellopsis*, *Fischerella*, *Stigonema* and *Chlorogloeopsis* in the paddy field soil have been described by many Indian workers (Banerji 1935, Singh 1939, , De 1939, Mitra 1950, Pandey 1962 and Singh 1961).

Recently nitrogen fixation and nitrogenase activities in (*Hapalosiphon fontinalis, Hapalosiphon Welwitschii, Westiella sp., Fischerella muscicola, Fischerella Major, Westiellopsis prolifica, Stigonema*

dendroideum, Chlorogloeopsis fritschii and *Parthasarathiella prolifica)* have been studied by number of workers (Fogg 1951, , Mitra 1961, Fay and Fogg 1962, Laloraya and Mitra 1972).

Three methods are popular for the estimation of nitrogen fixation (1) by estimation of total nitrogen by Kejldahl method (2) by 15Nisotopic technique (3) by acetelene reduction assay for nitrogen fixation. The authors selected the estimation of nitrogenars activity by ARA technique for ten selected strains of stigonematales.

MATERIALS AND METHODS

Nitrogenase activity has been estimated in ten selected strains of Stigonematales that includes *Chlorogloeopsis* (1 strain), *Hapalosiphon* (4 strains), *Westiellopsis* (4 Strains) and *Nostochopsis* (1 strain). Which were available in phycology laboratory, Department of Botany, University of Allahabad. These strains were maintained in our germplasm collection of Cyanobacteria under controlled laboratory conditions. In the present study Nitrogenase activity of these strains studied with their isolation in unialgal and axenic culture. It was grown in BG-11 medium (Stanier *et al*. 1971 liquid nitrogen deficient medium (- N medium) without combined nitrogen. It was decided that the above selected ten strains were morphologically different from each other. Therefore, these strains were selected for their detailed study.

The more useful and widely applied method for the estimation of nitrogen fixation is the reduction of C_2H_2 to the C_2H_4 (Hardy *et al.,* 1973) which can easily be separated by gas chromatograph. It was measured by using nitrogen as the carrier gas (Stewart *et al.,* 1967).

During the present work nitrogenase activity of selected strains was estimated by C_2H_2 reduction (Hardy *et al.,* 1973) assay method.

The acetylene reduction assay (ARA) was done through gas chromatograph (Amil Nucon 5700) attached with Flame Ionization Detector (FID). Nitrogenase activity was observed by *"In-situ*" acetylene reduction technique with the help of 650nm and 665nm with the help of Spectrophotometer (Systronics-108) as described by Mackinney (1941).

RESULTS AND DISCUSSION

In the experiment inter-generic variation were observed in available isolate for their ARA value in 10 and 20 days growth intervals. The ARA value varies .In Chlorogloeopsis-from 0.9320 to 1.172, In Hapalosiphon From 1.456 to 8.965, in Westiellopsis- From 1.285 to 6.523,in Nostochopsis-1.648 to 2.340n mole C2H2 /mg chl/ h. In the present study out of ten selected strains of Stigonematales inter-specific variation were also observed In Hapalosiphon, Hapalosiphon-53 showed best ARA value (8.965 and 5.448) than in Haplosiphon 196 (5.383 and 2.847) than in Haplosiphon.350 (2.862 and 2.377) , than in Haplosiphon.384 (2.019 and 1.456) in 10 and 20 days growth intervals respectively) in Westiellopsis, Westiellopsis-61 showed best ARA value (6.532 and 2.582), than in Westiellopsis-392 (6.398 and 2.112), than in Westiellopsis-29 (2.321 and 2.346) than in Westiellopsis-370 (2.001 and1.285) (in 10 and 20 days growth

Agriculture income:

The total income from crops and livestock production was considered as the agriculture income. The annual average family income from agriculture was estimated as Rs. 9352 and Rs. 8909 in Kumaon and Garhwal region, respectively. The total agriculture income increased with the increase in size of land holdings in both regions and among all the livestock production sub-systems. It was highest in the families following LPS-1 based on rearing of only buffaloes comparatively to other livestock production sub-system in both the regions.

Income from service:

Income from service included the income from business, daily paid labour and regular employment from government/private sector etc, and it was observed that about 85 percent of the annual/gross average family income in both Kumaon and Garhwal region was from service and about 15 percent of total average family income was from agriculture sector. Service income differed significantly among various sizes of land holdings and it increased with increase in size of land holdings in both the region indicating that farmers with large size land holdings were having better jobs than small ones. This may be due to higher education opportunities available to their family members and their better economic conditions. However, no trends were observed for service income among different livestock production sub-systems in both the regions of this study.

Annual gross family income

The annual gross average family income was estimated about Rs. 62,228 and Rs. 61,666 in Kumaon and Garhwal region respectively indicating slightly higher average family income. The annual gross family income increased with the increase in size of land holdings in both the region.

CONCUSSION:

The human and livestock density per hectare of geographical area were slightly higher in Kumaon region than the Garhwal region i.e. 4.04 v/s 3.83 and 2.27 v/s 1.72, respectively. The small, medium and large size house hold constituted 77.29, 18.14 & 4.58 percent and 67.89, 27.24 & 4.66 percent in Kumaon and Garhwal region, respectively. The cultivable areas owned by small, medium and large size were 50.03, 32.50 & 17.48 percent in Kumaon and 39.69, 45.81 & 14.50 in Garhwal region. The wheat was the principal grain crop occupying the highest cultivated area in Kumaon (25.08%) and Garhwal (34.25%). Minor millet (30.19 & 19.18) and Paddy (24.53 & 23.29) were another important cereal crops. The lack of irrigation facilities in the study area is one of the major problem in crop production. The non availability of appropriate technologies, use of poorly fermented organic manure, use of unimproved seeds and insect-pests are faced by the farmer. The average number of cattle and buffalo owned by farmers in Kumaon & Garhwal region were 2.08 & 0.65 and 1.23 & 1.72, respectively indicating that the cows in Garhwal region may not be preferred milch animal. The third major livestock was goat (26.08%) of the total livestock in the study area. The ship was practically absent from Kumaon region and constituted less than 1% in Garhwal region. The poultry constituted about 7.71% of the total livestock and poultry production in the study area.

The animal feeding practices in both the

Table 8. Income from various sources under different categories in Garhwal region of Uttarakhand

Parameter	Crops income	Livestock income	Agriculture income (Crop + livestock	Service income	Annual income
Pooled (601)	3437 (5.57)	5472 (8.87)	8909 (14.45)	52757 (85.55)	61666
Categories					
Small (408)	2554 (4.39)	4879 (8.39)	7433 (12.78)	50707 (87.22)	58140
Medium (165)	4052 (5.33)	5977 (7.87)	10029 (13.20)	65947 (86.80)	75976
Large (28)	7889 (8.75)	7200 (7.98)	15089 (16.73)	75090 (83.27)	90179
LPS Systems					
LPS-1	4077 (6.53)	7375 (11.82)	11452 (18.35	50942 (81.65)	62394
LPS-2	2094 (3.61)	2521 (4.34)	4615 (7.95)	53430 (92.05)	58045
LPS-3	2560 (4.39)	2499 (4.28)	5059 (8.67)	53276 (91.33)	58335
LPS-4	3583 (5.68)	6210 (9.85)	9793 (15.53)	53280 (84.47)	63073
LPS-5	3125 (4.85)	8126 (12.61)	11251 (17.46)	53183 (82.54)	64433
LPS-6	2114 (3.90)	9207(16.98)	11321 (20.88)	42890 (79.12)	54211

Figures in parentheses are in percent to annual income

Similarly in Garhwal region, the annual average family income from livestock production was estimated as Rs. 5471.63. The income form livestock production also differed among the various livestock production sub-systems and it was observed that income from livestock sub sector was highest in LPS-6 (Rs. 9207) followed by LPS-5 (Rs. 8126), LPS-1 (Rs. 7376), LPS-4 (Rs. 6210), LPS-2 (Rs. 2521) and LPS-3 (Rs. 2499). Since, LPS-6 and LPS-5 was adopted by a very small number of the farmers thus LPS-1 which has been adopted by majority of the families (53 per cent) emerged as the most important livestock production sub-system in Garhwal region. This also indicated that farmers rearing only buffaloes alone or in combination of other livestock have higher income from livestock production sub-sector in both regions. In the light of the above results it emerges that farmers should be advised and encouraged to follow LPS-6. Rearing of cows and poultry with buffaloes will increased income form livestock production and hence, will increase overall agriculture income of the farmer.

Crop production v/s livestock production:

Total annual average family incomes were always higher from livestock production than from crop production sub-sector in both the region. This highlights the importance of livestock production in hills. The income from both crop and livestock production generally increased with the increase in the size of land holdings in both the region. Among various livestock production sub-systems, the income from crops sub-sector were highest in LPS-1, which was based on buffalo rearing alone in both the region than any other livestock production sub-system.

intervals respectively). Out of four genera of Stigonematales Such as Chlorogloeopsis-Hapalosiphon Nostochopsis- and Westiellopsis, Hapaloshipon showed best ARA value than other three strains than Westiellopsis than Nostochopsis-than Chlorogloeopsis- ie Chlorogloeopsis showed least ARA value And Hapaloshipon showed the best ARA value and in Hapalosiphon . Hapalosiphon-53 was best ARA value Members of Stigonematales have capacity to fix atmospheric nitrogen this was first time demonstrated by Fogg (1951) in Mastigocladus laminosus. It was isolated from hot spring in England. The occurrence of nitrogen fixing Stigonematalean genera such as Hapalosiphon, Westiellopsis, Fischerella, Stigonema and Chlorogloeopsis in the paddy field soil have been described by many Indian workers (Banerji 1935, Singh 1939, , De 1939, Mitra 1950, 1951, Pandey 1962 and Singh 1961). Thus the present cstudy revealed that mast of the selected strains of Stigonematales also showed best ARA value in nitrogen enriched medium therefore they are also used as a biofertilizer in rice field

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TABLE - 1 Nitrogenase activity of different strains of Stigonematales in nitrogen deficient medium

STRAINS	Nitrogenase Activity (n mole μgC_2H_4/Ch.a /h)	
	-N medium	
	10 day	20 day
***Chlorogloeopsis*-354**	1.172	0.9320
Nostochopsis **-368**	1.648	2.340
Hapalosiphon **-53**	8.965	5.448
Hapalosiphon **-196**	5.383	2.847
Hapalosiphon **-350**	2.862	2.377
Hapalosiphon **-384**	2.019	1.456
Westiellopsis **-29**	2.321	2.346
Westiellopsis **-61**	6.523	2.582
Westiellopsis **-370**	2.001	1.285
Westiellopsis **-392**	6.398	2.112

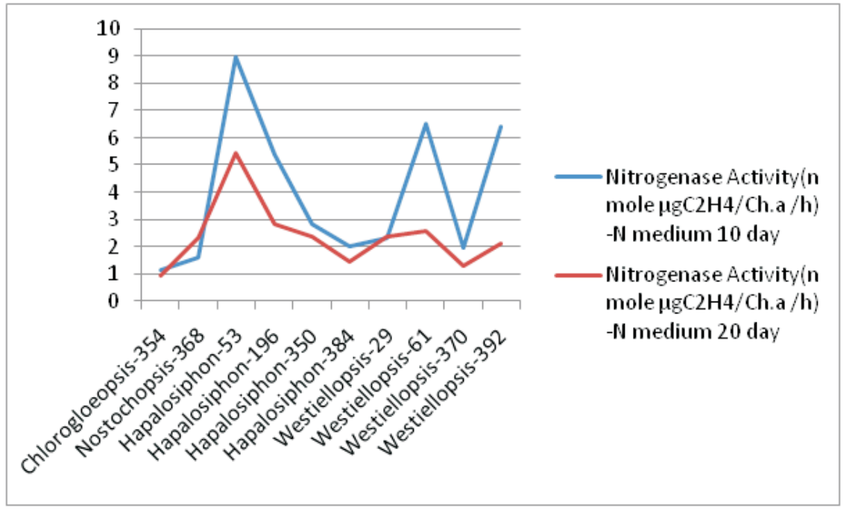

Fig. Nitrogenase activity of different strains of Stigonematales after 10 and 20 days growth intervals.

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Henriksson, E., Englund, B., Henden, M. B., and Was, I., (1972). In Taxonomy and

annual average family income. The income from crops under different livestock production sub-systems also differed and it was highest under the LPS-1 (Rs. 4077), which was based on buffalo alone. It was followed by LPS-4 (Rs. 3583), LPS-5 (Rs. 3125), LPS-3 (Rs. 2560), LPS-6 (Rs. 2114) and LPS-2 (Rs. 2094). Further the trends in annual average family incomes from crop production under different livestock production system in Kumaon and Garhwal region were almost similar and indicated that farmers rearing only buffaloes had higher income from the crops in both areas. This may be because of buffaloes are generally reared under stall fed system and buffalo dung is collected throughout the year and used as manure in the crop production, while cow and goat are left loose for grazing in the forest, thus their dung goes as waste. Further, the regular income from the sale of the milk of buffalo also facilitates the farmer to buy fertilizer and other inputs add to the crop productivity.

Income from livestock production:

To calculate annual livestock income, monthly/annual income from sale of milk and livestock animals was added. Home consumed milk was also given weightage while calculating annual income. The average annual income from livestock production in Kumaon region was estimated as Rs. 6316. The income from livestock production in Kumaon region was differed among the categories of the size of the holding. It was higher in families with large land holding than small and medium size land holding, which could be because of the more land resources available with farmers having large land holdings for rearing buffaloes under stall fed system. Same pattern was observed in Kumaon region. The annual average income from livestock production in Kumaon region differed among different livestock production sub system and it was higher in LPS-1 (Rs. 6793), which was based on buffaloes alone. This was followed by LPS-5(Rs 4347), LPS-6 (Rs 3966), LPS-4 (Rs. 2886), LPS-3 (Rs. 3768) and LPS-2 (Rs. 2441) including that farmers rearing only buffaloes had higher income than rearing cattle or any other combination of livestock.

Table 7. Income from various sources under different categories in Kumaon region of Uttarakhand

Parameter	Crop income	Livestock income	Agriculture income (Crop + livestock)	Service income	Annual income
Pooled (612)	3036 (4.88)	6316 (10.15)	9352 (15.03)	52876 (84.97)	62228
Categories					
Small (473)	2640 (4.53)	6190 (10.63)	8830 (15.17)	49396 (84.83)	58226
Medium (111)	3915 (5.49)	5834 (8.18)	9749 (13.67)	61589 (86.33)	71338
Large (28)	6236 (6.60)	10425 (11.03)	16661 (17.63)	77832 (82.37)	94493
LPS Systems					
LPS-1	4217 (7.04)	6793 (11.35)	11010 (18.39)	48853 (81.61)	59863
LPS-2	2158 (3.34)	2441 (3.78)	4599 (7.12)	59963 (92.88)	64562
LPS-3	2597 (4.07)	3768 (5.90)	6365 (9.97)	57461 (90.03)	63826
LPS-4	3592 (5.61)	3886 (6.07)	7478 (11.69)	56503 (88.31)	63981
LPS-5	2497 (3.99)	4347 (6.95)	6844 (10.94)	55735 (89.06)	62579
LPS-6	2326 (4.91)	3966 (8.37)	6292 (13.28)	41085 (86.72)	47377

Figures in parentheses are in percent to annual income

Table 6. Number of farm under different livestock and poultry production sub-systems on sample farm

S. No.	livestock production system	Kumaon region	Garhwal region
1.	LPS-1 (Buffalo alone)	204 (33.33)	319 (53.07)
2.	LPS-2 (Cattle alone)	137 (22.38)	9 (1.50)
3.	LPS-3 (Buffalo+Cattle)	116 (18.95)	104 (17.30)
4.	LPS-4 (Buffalo+Goat)	56 (9.15)	62 (10.32)
5.	LPS-5 (Buffalo+Cattle+Goat)	34 (5.56)	35 (5.82)
6.	LPS-6 (Buffalo+Cattle+Poultry)	10 (1.60)	5 (0.83)
7.	Others	55 (9.03)	67 (11.16)
	Total	612	601

Figures in parentheses are in percentage to total

Buffalo+Cattle+Poultry based (LPS-6) sub systems. However four major sub systems dominated in both the region. These sub systems revealed that in Garhwal region, most of farmers (53.07%) were rearing only buffaloes along with buffalo based (LPS-3) was identified as another dominate livestock production sub system LPS-3 (17.30%) followed by LPS-4 (10.32%), LPS-5 (5.82%), LPS-2 (1.5%) and LPS-6 (0.83%) and rest 11.16% families were rearing other different combination of livestock along with grain crop and horticultural crops. In Kumaon region, most prevalent livestock sub system was also LPS-1 (33.33%) followed by LPS-2 (22.38%), LPS-3 (18.95%), LPS-4 (9.15%), LPS-5 (5.56%) and LPS-6 (1.60%). The remaining 9.03% of the farmers were rearing other than the above combination of livestock along with grain and horticultural crops which could not be considered as major sub system in either of the region. Further, it was also revealed that in Garhwal region buffalo was the most favored animal/livestock (53.07%) while cattle were most popular in Kumaon region (22.38%).

Income on sample farm:

Per farm income from crops, livestock and other sources in various categories of land holdings and livestock production sub system in Kumaon and Garhwal region are presented in Table 7 and 8, respectively.

Income from crop production:

To calculate gross income from crops and vegetable production the output was multiplied by prevailing price of the commodities in the market. Annual average family income from crop production in Kumaon region was estimated about Rs 3036 which was 4.88% of total annual family average income. Income from crop also differed among various livestock production sub-systems. The average annual family income from crops sub-sector was higher in LPS-1 (Rs. 4217) followed by LPS-4 (Rs. 3592), LPS-5 (Rs. 2947), LPS-3 (Rs. 2597), LPS-6 (Rs. 2326) and LPS-2 (Rs. 2158). It was observed that farmers rearing only buffaloes had higher income from the crops. The average annual family income form crops sub-sector in Garhwal region was Rs. 3437, which constituted 5.57 per cent of the total

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Problem in crop production

The lack of irrigation facility in the study area is one of the major problems in crop production. The non-availability of appropriate technologies, use of poor fermented organic manure, use of seed of un-improved crop varieties, insects particularly white grub, pests, crop damage by wild animals etc. are among the other problem faced by the farmers in the study area. The crop yields are therefore, low leading to insufficient grain production to feed the local population. The farmers are skeptical about the use of land for production of off-season vegetables, fruit and other crops may be partly because of different terrain, non-availability of marketing infrastructure including fruits and vegetables processing industry. Wherever, infrastructures particularly in the form of roads have been developed, the farmers had been tried to opt vegetable production.

Livestock & poultry inventory on sample farm

The average number of cattle and buffalo owned by farmers in Kumaon & Garhwal region were 2.08 & 0.65 and 1.23 & 1.72, respectively indicating that the cows in Garhwal region may not be preferred milch animal. The third major livestock was goat (26.08%) of the total livestock in the study area. The ship was practically absent from Kumaon region and constituted less than 1% in Garhwal region. The poultry constituted about 7.71% of the total livestock and poultry production in the study area.

Table 5. Livestock and poultry inventory on sample farm (No)

S. No.	Livestock & Poultry	Kumaon region	Garhwal region	Total /Overall
1.	Cattle	2.08(43.15)	0.65 (16.21)	1.37 (31.07)
2.	Buffalo	1.23 (25.52)	1.72 (42.89)	1.47 (33.33)
3.	Sheep	-	0.03 (0.75)	0.01 (0.23)
4.	Goat	0.98 (20.33)	1.34 (33.42)	1.15 (26.08)
5.	Others	0.04 (0.83)	-	0.02 (0.45)
6.	Draft animal	0.04 (0.83)	0.05 (1.25)	0.05 (1.13)
7.	Total livestock	4.37 (90.66)	3.79 (94.51)	4.07 (92.29)
8.	Poultry	0.45 (9.34)	0.22 (5.49)	0.34 (7.71)
9.	Total livestock & Poultry	4.82	4.01	4.41

Figures in parentheses are in percentage to total

Livestock production sub system:

Characterization of livestock production sub system (LPS) is presented in Table 6. A total of six classes of livestock and poultry farming were identified as common sub classes in both the region which were designated as Buffalo based (LPS-1), Cattle based (LPS-2), Buffalo+Cattle based (LPS-3), Buffalo+Goat based (LPS-4), Buffalo+Cattle+Goat based (LPS-5) and

region (0.43 ha) was slightly higher than the Kumaon region (0.41 ha). Thus, the small, medium and large sized farmers owned 44.80, 39.23 and 15.97 per cent of the total land in the overall area. It is further show that the small and large size farmer constituted 50.03 and 17.48 per cent of total land was also higher in Kumaon region than the 39.69 and 14.50 per cent respectably in the Garhwal region. While the medium size of farmer constituted 45.81 per cent of total land in Garhwal region was much higher than the Kumaon region (32.50 per cent).

Table 2. Land holding pattern on sample farm

S. No.	Particulars	Kumaon region				Garhwal region				Total/ Overall			
		Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
1.	No of sample farms	473 (77.29)	111 (18.14)	28 (4.58)	612 (100)	408 (67.89)	165 (27.45)	28 (4.66)	601 (100)	881 (72.63)	276 (22.75)	56 (4.62)	1213 (100)
2.	Cultivated area (ha)	125.96 (50.03)	81.82 (32.50)	44 (17.48)	251.78 (100)	102.2 (39.69)	117.96 (45.81)	37.34 (14.50)	257.5 (100)	228.16 (44.80)	199.78 (39.23)	81.34 (15.97)	509.28 (100)
3.	Average size of holding (ha)	0.27	0.74	1.57	0.41	0.25	0.71	1.33	0.43	0.26	0.72	1.45	0.42

Note: Figures in parenthesis are percentage of their total

Cropping pattern

The per farm area under different crop in Kumaon and Garhwal region are presented in Table 3. Table reveals that the wheat was the principal grain crop occupying the largest percentage of the cropped area in all the categories of farms in both regions. The average value for grain crops in Kumaon and Garhwal region being 92.45 and 95.89 per cent, respectively. On an overall basis in Kumaon region, wheat (32.08%) was followed by minor millets (30.19 %) and paddy (24.53 %) and in Garhwal region wheat (34.25 %) was followed by paddy (23.29 %) and minor millet (23.81 %). Vegetable occupied about 6.35% in the overall area, with Kumaon region having a higher area covered compared to Garhwal region (7.55 v/s 4.11).

Table 3. Cropping pattern on sample farm (ha)

S. No.	Crops	Kumaon region	Garhwal region	Average
1.	Total Grain crops	0.49 (92.45)	0.70 (95.89)	0.59 (93.65)
(i)	Wheat	0.17 (32.08)	0.25 (34.25)	0.21 (33.33)
(ii)	Minor millet	0.16 (30.19)	0.14 (19.18)	0.15 (23.81)
(iii)	Paddy	0.13 (24.53)	0.17 (23.29)	0.15 (23.81)
(iv)	Others	0.02 (3.77)	0.13 (17.81)	0.08 (12.70)
2.	Total vegetable crops	0.04 (7.55)	0.03 (4.11)	0.04 (6.35)
3.	Gross Cropped area	0.53	0.73	0.63
4.	Cultivable area	0.41	0.43	0.42
5.	Cropping intensity	129.46	169.98	149.54

Figures in parentheses are in percent to gross cropped area

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A STUDY ON PERSONAL PROFILE AND ADOPTION LEVEL OF FOOD TECHNOLOGY TRAINEES IN RELATION TO SELF EMPLOYMENT IN FOOD PROCESSING ENTERPRISES.

[1]Surya Narayan, [1]Manoj Kumar Singh,[2] S.P. Verma and [3]Bipin Kumar
1. Department of Horticulture, K.A.P.G. College, Allahabad, (U.P.), India
2. Department of Animal Husbandry and Dairying , K.A.P.G. College, Allahabad, (U.P.), India
3. Department of Plant Pathology, K.A.P.G. College, Allahabad, (U.P.), India

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ABSTRACT

The survey was conducted in sixty respondents with a view to ascertain the personal profile of respondents and adoption level of food related enterprises by trainees under Food Technology programme implemented in the Department of Horticulture at K.A.P.G. College, Allahabad during 2012-13. The Study inferred that majority of the respondents were of middle age group, School level educated, middle income group with high mass media exposure. The component of Food Processing Enterprises (FPE). such as Fruit Based Enterprise, Vegetable Based enterprise, Shop Own opening, Marketing ,Raw material Supplier, NGOs for cooperatives and Govt. Service were found to be adopted by the majority of the respondents. However, the components such as marketing, own shop opening and raw material supplier were poorly adopted by them which need intensive training in ordered to develop the skill among the participants.

Keywords: *Adoption, enterprise , trainees, personal Profile.*

Scientific development makes thinks easy to practice and enhances efficiency in term of time and capital investment. This ultimately improves income generation, hence happiness. Diversification of agro-based product, agriculture enterprises, innovations, Indigenous Technological Knowledge (ITKs), and crucial inputs has become imperative in limited unit of limited resource for not only quality produce and profit optimization but also for employment, sustainability, eco-friendly and holistic development. To achieve such a pilot goal the policy makers, administrators, scientist and even farmers have realized for agriculture produce diversification. In his regard, training is very potent tool to conceptualize and impart knowledge and transfer skill to the trainees.

Indiscriminate use of chemicals caused alarming situation in the field of health, food, cloth and biosphere. We have rich wealth of I.T.Ks. for quality and yield improvement without any kind of deterioration. Rishi-Krishi, Homa-Farming, Biodynamic and Organic Farming are the few examples of such type of I.T.Ks.

Ascertaining Profiles is an important approach to draw definite conclusions about the participants. Characters like, cost , education, income, mode of income, social participation, and mass media exposure are critical predictors

influencing the skill development and technology adoption.

Adoption of FPE. at gross level is very complex phenomenon which governs by several obvious and hidden factors. Despite similar training package adoption variabilities are observed in practical situation.

In view of above facts, it was felt imperative to examine the adoption level of Food Technology trainees in relation to Self Employment in Food Processing enterprises.

MATERIALS AND METHODS

Respondents were selected purposively because of the potential keenness in the field of food processing. Investigation had covered the eighty respondents from various district which were actively engaged in Food Processing Program.

For the selection of the respondent a list of keen respondents from vide area was made. Total eighty respondents were trained on specialized subject. For the analysis of personal profile the data were collected through the personal interview method. The data related to adoption of FPE. were collected with the help of interview schedule. The collected data were analysed with the use of simple statistical tools and conclusion were drawn.

RESULTS AND DISCUSSION

Personal Profile of the Respondents:

Personal Profile included as Cost, Education, Income, Mode of income, Social Participation and Mass Media Exposure in the study.

As revealed from the Table 1, majority of the trainees (68.75%) were of OBCs group followed by General (18.75%) and 12.50% SCs & STs. In education point of view 52.50 % had school level, 18.75 % each primary and graduate level and only 10.00% were found to be illiterate. Majority of trainees were of medium income (50%) group followed by 26.25 % low and 23.75% higher income group. Fifty percent were found to belong Service group followed by Business, (30%) and Farming (20 %). Very poor social participation was observed and 40 % were found in that no any membership whereas 28.75% were having one organization membership and 17.50 % with more than two organization membership but only 13.75 % were found to be office bearer. In relation to mass media exposure 41.25 % were medium level followed by low 31.25 % and 27.50% high. The findings are in the conformity with the findings of Patel & Thakkar (1991), Kokate (1980), Mishra (1994) and Rathour (2000).

ADOPTION OF B.P.P.

The analysed data are given in Table-2

It is evident from the Table-2 that majority of the trainees (78.10%) adopted the Food Processing Enterprises were of OBCs group followed by General (44.30%), SCs & STs group (37.80%); an average 69.28%, adopted one or more Enterprises and rest (30%), were not found to be adopters of any Enterprise. In education, over whelming majority of trainees 79.51% adopted is of school level, followed by graduation and above (57.10%), primary to middle (54.20%) and only 33.33% illiterate. Adoption percentage 83.80 was greater with medium income group followed by higher income group (71.43%) and least (31.25%) with low income group. Trainees with Service group have had higher adoption (75.23%), followed by Business(68.89%), and Farming (51.91%). Role of social participation in adoption found to be ineffective and 78.81%

MATERIALS AND METHODS

The state of Uttarakhand comprises of two divisions i.e. Kumaon and Garhwal and 13 districts. Out of which Almora district from Kumaon region and Tehri Garhwal district from Garhwal region were selected purposively. Tarikhet and Narendranagar block was selected randomly from Almora and Tehri Garhwal respectively. The selection of villages within block was based on the marketable surplus of milk, its accessibility and vicinity to the market place. The broad general information about the potential villages was collected using rapid appraisal technique. A list of all the revenue villages was prepared with the help of respective block headquarter. 17 villages were taken from each selected block, thus a total number of 34 villages were selected randomly from both the region. These farmers were then categorized under three size group i.e. small (up to 0.5 ha), medium (0.5 to 1 ha) and large (above 1 ha). Then the sample of 612 farmers (473 small, 111 medium and 28 large) from Tarikhet block in Kumaon region and 601 (408 small, 165 medium and 28 large) from Narendranagar block in Garhwal region were selected randomly. Thus, the total 1213 sample farmers were selected randomly for the present study.

The data were pertained to the year 2010-11. The primary data on land holding pattern, cropping pattern, livestock and poultry inventory and annual returns from different enterprises like agriculture, livestock, poultry etc were collected through personnel interview with the help of pre-tested schedule. The information on employment generation from various production systems were also taken from farmers.

RESULTS AND DISCUSSION

Human and livestock population density

The human and livestock population density is presented in Table 1. Table reveals that the human population density per hectare of geographical area was slightly higher in Kumaon region than the Garhwal region (4.04 v/s 3.83) Similarly average livestock density per unit of geographical area was higher in Kumaon region than Garhwal region (2.27 v/s 1.72) the human livestock ratio observed was around 2.

Table 1. Human and livestock population density

S. No.	Particulars	Kumaon region	Garhwal region	Overall
1.	Human density/ha geographical area	4.04	3.83	3.93
2.	Livestock density/ha geographical area	2.27	1.72	1.99
3.	Human: livestock ratio	1.78	2.23	2.00

Categorization of land holding

It may be seen from Table 2 that the small, medium and large size land holdings (77.29, 18.14 and 4.58 per cent respectively) of the total sample farms in Kumaon region was slightly lower than the Garhwal region i.e. 67.89, 27.45 and 4.66 percent. It may also be seen these the average size of land holding by small, medium and large sized farm was 0.27, 0.74 and 1.57 ha in Kumaon region, and 0.25, 0.71 and 1.33 ha in Garhwal region while overall land holding by farmer in Garhwal

Livestock also constitute a 'living bank' providing flexible financial reserves in times of emergency and serve as 'insurance' against crop failure for survival. The Integrated Farming System (IFS) has revolutionized conventional farming of livestock, aquaculture, horticulture, agro-industry and allied activities in some countries, especially in tropical and subtropical regions which are not arid. The Integrated Farming System can remove all these constraints by solving most of the existing economic and even ecological problems along with providing the needed means of production such as fuel, fertilizer and feed, besides increasing productivity many-fold. It can turn all those existing disastrous farming systems, especially in the poorest countries, into economically viable and ecologically balanced systems that will not only alleviate poverty, but can even eradicate this scourge completely.

The farming followed by the hill farmers is unscientific and the income generated through such farming is hardly sufficient to meet livelihood. However, using the existing resources the farming system can be made viable, sustainable and income generating with great opportunities of employment potential. Since Uttarakhand state is dominated by the marginal and small holding, different modules have been structured to utilize and recycle the available resources to level out their socio-economic status. Therefore, the study was conducted in the Uttarakhand state having reported area about 5.672 million ha whereas more than 85 per cent area is hilly and rest of the area is plain. The hill region has become a distinct socio-economic region on account of its topography peculiar geographical feature as compared to the plain. Economically the hill region is quite backward. Though the whole economy of the region is based on agriculture, the total cultivable land is only 14 per cent of the total reported area. About 67 per cent of the total working population is engaged in agriculture and more than 78 per cent of the population depends upon the agriculture for its livelihood. Paddy, wheat, maize and coarse cereals are major crops grown in the hill area.

Under the changing farm economy, food crop production even in best circumstances is marginally profitable enterprise. There is thus, need to look for ways by which farmers can make more effective use of their land, labour and capital. Usually this can be done by diversification of the production system. Depending upon skills and resources farmer may opt for more than one enterprise. In farming system research we need to determine the relative proportion of different agriculture enterprises for a particular area. In the hill area farmer's resource base is very low. Usually there are short of cash and labour availability for new enterprises. The importance of dairy animal in the area could be judged from the fact that about 15 per cent of the total cultivable area is allocated for fodder production. In view of the role played by livestock and poultry in the study area, it is essential that the farming system approach be applied in studying the contribution of livestock and developing alternative strategies for optimal production of livestock and poultry in the study area. The specific objectives were: (a) to work out the cropping pattern in the study area; (b) to categorize the existing livestock and poultry production sub-system under integrating farming system in the study area, and (c) to assess the income from various sources under different categories and livestock production system prevalent in the study area.

TABLE-1 : PERSONAL PROFILE OF B.P.P. TRAINEES

Cost Structure	**Frequency**	**Percentage**
(a) General	15	18.75
(b) OBCs	55	68.75
(c)SCs& STs	10	12.50
Total	**80**	**100**
Educational Qualification		
(a) Illiterate	8	10.00
(b) Primary to middle	15	18.75
(c) School level	42	52.50
(d) Graduate and above	15	18.75
Total	**80**	**100**
Annual Income in Rupees		
(a) Low (up to Rs. 30,000)	21	26.25
(b) Medium (more than Rs. 30,000 and up to Rs. 60,000)	40	50.00
(c) High (more than Rs. 60,000)	19	23.75
Total	**80**	**100**
Mode of income		
(a) Service	40	50.00
(b) Business	24	30.00
(c) Farming	16	20.00
Total	**80**	**100**
Social Participation		
(a) No membership	32	40.00
(b) Member of one organization	23	28.75
(c) Member of More than one organization	14	17.50
(d) office bearer	11	13.75
Total	**80**	**100**
Mass Media Exposure		
(a) Low (up to 25)	25	31.25

TABLE - 2 : ADOPTION OF FPE

Personal Profile		Fruit Based Enterprise	Vegetable Based enterprise	Own Shop opening	Marketing	Raw material Supplier	NGOs for cooperatives	Govt. Service	Total Mean
Cost Structure		**Fr., %**	**Fr., %**	**Fr., %**	**Fr., %**	**Fr., %**	**Fr., %**	**Fr., %**	**Fr., %**
(a)General	15	8 (53.33)	7 (46.67)	4 (26.67)	4 (26.67)	7 (46.67)	5 (33.33)	4(26.67)	5.57 (44.30)
(b) OBCs 5		40 (72.72)	38 (69.09)	43 (78.18)	27 (60.00)	40 (72.72)	30 (75.00)	43 (78.18)	37.28 (67.27)
(c) SCs & STs	10	5 (50.00)	2 (20.00)	3 (30.00)	3 (30.00)	2 (20.00)	3 (30.00)	2 (30.00)	2.86 (28.60)
Total	**80**	**53 (66.25)**	**47 (58.75)**	**50 (62.50)**	**34 (42.50)**	**38 (63.33)**	**38 (63.33)**	**49 (61.25)**	**45.71 (56.25)**
Educational Qualification									
(a) Illiterate	8	2 (25.00)	1 (12.50)	2 (25.00)	0 (00.00)	0 (00.00)	0 (00.00)	2 (25.00)	1.00 (12.50)
(b) Primary to middle	15	8 (53.33)	5 (33.33)	7 (46.67)	4 (26.67)	4 (26.67)	3 (20.00)	8 (55.33)	5.55 (67.13)
(c) School level	42	30 (71.42)	35 (83.33)	33(78.57)	24 (57.14)	28 (66.67)	18 (42.76)	35 (83.33)	29.00(69.04)
(d) Graduate and above	15	8 (53.33)	7 (46.67)	5 (33.33)	3 (20.00)	4 (26.67)	4 (26.67)	7 (46.47)	4.14 (27.60)
Total	**80**	**48 (60.00)**	**48 (60.00)**	**47 (58.65)**	**31 (38.75)**	**36 (45.00)**	**25 (31.25)**	**52 (65.00)**	**39.69 (48.75)**
Annual Income in Rs.									
(a) Low (up to Rs. 30,000)	21	7 (33.33)	7 (33.33)	14 (66.66)	3 (14.28)	6 (28.56)	2 (12.67)	12 (57.12)	7.28 (34.68)
(b) Medium (more than Rs. 30,000 and up to Rs. 60,000)	40	28 (93.33)	26 (86.67)	30 (100)	21 (70.00)	22 (73.33)	21 (70.00)	28 (93.33)	25.14 (83.80)
(c) High (more than 60,000)	19	12 (85.71)	12 (85.71)	10 (71.43)	7 (50.00)	12 (85.71)	5 (35.71)	12 (85.71)	10 (71.43)
Total	**80**	**48 (80.00)**	**44 (73.33)**	**50 (83.33)**	**31 (50.10)**	**38 (63.33)**	**28 (46.00)**	**52 (86.67)**	**41.57 (69.29)**
Mode of Income									
(a) Service		27 (90.00)	24 (80.00)	28 (93.33)	17 (56.67)	20 (66.67)	14 (46.67)	28 (93.33)	25.57 (75.23)
(b) Business		15 (78.95)	14 (73.68)	16 (84.21)	9 (47.37)	13 (68.42)	10 (52.63)	16 (84.21)	13.28 (68.89)
(c) Farming		6 (54.55)	6 (54.55)	6 (54.55)	5 (45.45)	5 (45.45)	4 (36.36)	8 (84.2)	5.71 (51.91)
Total		**48 (80.00)**	**44 (73.33)**	**50 (83.33)**	**31 (50.10)**	**38 (63.33)**	**28 (46.00)**	**52 (86.67)**	**41.57 (69.29)**
Social Participation									
(a) No membership		23 (85.19)	23 (85.19)	24 (88.89)	19 (70.37)	20 (74.07)	16 (59.26)	24 (88.89)	21.28 (78.81)
(b) Up to one organization		12 (66.67.)	11 (61.11)	40 (77.78)	7 (38.89)	10 (55.56)	8 (44.44)	50 (83.33)	11.00 (61.11)
(c) Member of more than one organization		6 (66.67)	5 (55.56)	7 (77.78)	3 (33.33)	4 (44.44)	2 (22.22)	7 (77.78)	4.86 (54.00)
(d) office bearer		6 (100.00)	5 (83.33)	5 (83.33)	3 (50.00)	4 (66.67)	2 (33.33)	6 (100.00)	4.43 (73.81)
Total		**48 (80.00)**	**44 (73.33)**	**50 (83.33)**	**31 (50.10)**	**38 (63.33)**	**28 (46.00)**	**52 (86.67)**	**41.57 (69.29)**
Mass Media Exposure									
(a) Low (up to 25)		17 (85.00)	15 (75.00)	16 (80.00)	9 (45.00)	12 (60.00)	9 (45.00)	17 (85.00)	13.57 (67.89)
(b) Medium (> 25 to 50)		19 (82.61)	18 (78.26)	19 (82.61)	12 (52.17)	13 (56.52)	11 (47.83)	20 (86.96)	16.00 (69.57)
(c) High (> 50)		12 (70.59)	11 (64.71)	15 (88.24)	10 (58.82)	13 (66.47)	8 (47.06)	15 (88.24)	12.0 (70.59)
Total		**48 (80.00)**	**44 (73.33)**	**50 (83.33)**	**31 (50.10)**	**38 (63.33)**	**28 (46.00)**	**52 (86.67)**	**41.57 (69.29)**

adopters had no social linkage while 73.81% adopters were found to be office bearer and 61.11% were associated with one organization and 54.00% had linkage with more than one organization. Mass media exposure yielded greater adoptability and 70.59%, adopters were of high exposure of mass media followed by medium (69.57%) and 67.85% low.

These findings are supported with the

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LIVESTOCK AND POULTRY INTEGRATED FARMING SYSTEM FOR AUGMENTING SOCIO-ECONOMIC STATUS OF HILL FARMER IN UTTARAKHAND

Hargovind Bhargav
Department of Agricultural Economics
K.A.P.G. College Allahabad-211001 (U.P.), India

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ABSTRACT

Integrated farming system (IFS) comprising of crop and livestock has been sustainable over centuries. This study has shown the possible integrated farming systems with their benefits comparatively to traditional cropping systems. The study has also provided the information about the cropping pattern, based on the field level information from the state of Uttarakhand. The annual income from agriculture, livestock and service sectors was calculated. It has been found that returns from integrated farming systems are higher than traditional cropping systems. The study has mentioned the employment generation from various systems. The most profitable IFSs are LPS-1, LPS-5, LPS-6 etc.

Keywords : *Livestock poultry, IPM*

Integrated Farming System (IFS) could be able to meet food needs of the ever-increasing population. Integrated farming systems seems to be the possible solution to meet the continuous increase in demand for food, stability of income and diverse requirements of food grains, vegetables, milk, egg, meat etc., thereby improving the nutrition of the small-scale farmers with limited resources. Integration of different agriculturally related enterprises with crops provides ways to recycle products and by-products of one component as input through another linked component and reduce the cost of production and thus raises the total income of the farm. In other words, farming system is a resource management strategy to achieve economic and sustained production to meet diverse requirement of farm household while preserving resource base and maintaining a high-level environment quality

In this system animals are raised on agricultural waste and the animal power is used for agricultural operation and voids are used as manure and fuel. Summarily, the waste of one enterprise becomes the input of another leaving no waste to pollute the environment. However, even if this has been a big step forward, it still requires some external input to increase farm productivity and produce processing in agro-industry. So it has remained inadequate to lift the small farmers out of poverty, because of the continuously rising costs of the inputs, such as chemical fertilizer, artificial feed and fossil fuel. Further innovations with increasing productivity are necessary to push the integrated farming system. To put this concept into practice efficiently, it is necessary to study linkages and complementarities of different enterprises that will help to develop integrated farming system.

For human need, the livestock provide food, fiber, skin, traction, fertilizer and fuel.

findings of Choudhary et. al. (1988) Singh & Singh (1990), Reddy et. al. (1982) and Kokate (1980).

SUMMARY

Majority of trainees were of middle age group (75.00%) with medium income group (50.00%) and school level education (61.67%). They Service catagory (50.00%), with poor social participation (45.00%) and having medium mass media exposure (38.33%). Illiterate (5.00%) and old age (8.33%) participant number was least, which indicates that our respondent community structure had changed as compared to those of early days. Socio-economic status was also found to medium in nature which is some what static in position as compared to past one. Personal profile such as age, education, income, source of income and mass media exposure had influenced the level of adoption of food processing enterprises significantly .

CONCLUSION

It can be concluded that this study on personal profile and adoption level of Food Technology trainees in relation to Self Employment in Food Processing enterprises was found to be significantly effective and personal profiles of the participants too had affected the adoption of FPE significantly.

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production may come upto 80 per cent when the milk production primarily depends upon concentrate based feeding, nearly 65 percent of the total expenditure of milk production in cows is attributed to the feeding of animals when both concentrates and green fodders are fed as mixed ration, while on forage based feeding it could reduced to only 40 percent of the total expenditure (Das and Mehta, 2010). Lover genetic potential, inadequate supply of quality feed and fodder and lack of health care and management are important reasons for low productivity of the animals (Yadav, 2007). Further, milch animals specially require good quality nutritious forages, which has many additional benefits for expression of full genetic potential of milk production.

It is well known fact that the importance of quality feed and fodders in attaining maximum genetic potential of Indian Cattle, including the indigenous breeds is well recognized and documented by several researchers. Garg (2012) reported that milk production in dairy animals can be improved through balanced feeding there is a considerable scope for the enhancement of milk production with existing feed and animal resources.

From the perusal of the data depicted in Table-1 it is evident that berseem feeding to dairy animals along with existing feeding practices had enhanced the average milk yield of animals from 30.44 – 37.03 per cent in different years. The demonstrations of berseem variety – JB-1, Vardan and JHB conducted by zone-iv during 2010-11 under FLD reported 938, 597, 575 q/ha yield respectively with an increase of 21, 25, 31 percent under farmer's field are in agreement to preset findings. Similarly 25 demonstrations conducted by KVKs of zone-iv during 2014-15 reported an average yield of only 316.4 q/ha which is contrary to present investigation may be attributed to variety, climate and location of the area.

The results of the present investigation have also proven that the feeding of chaffed green berseem along with dry fodder bhusa / paddy straw supplemented with traditional feeding system and home made concentrate mixture gave 30.44–37.30 percent increase in milk yield of milch animals under FLD farmers after 30-35 days of starting feeding green.

Adlib green feeding was not practiced, but majority of them fed green legumes as well as non-legumes along with other available fodders. Findings of Panwar (1992) and Rathore (2009) who reported 34.25 percent farmers cultivated and fed green fodder to their buffaloes round the year, are contrary to the finding of present study and in consonance to Swaroop *et al*. (2014).

CONCLUSION

On the basis of findings of the present investigation, it may be concluded that existing feeding practices were not very satisfactory in the study area. Rice–wheat being the predominant cropping system in the area, none of the farmers fed single green fodder. Traditional system of livestock rearing with grazing on fallow/harvested fields along with sani with locally available roughage and concentrate/ wheat flour prior to milking was the most common feeding practice. Respondents after FLD period were aware of scientific livestock feeding and realized that milch animals should be fed adequate quality of green fodder to obtain their potential yield Thus there is a tremendous scope of scientific feeding with available feed and green leguminous fodder for optimum and economical production.

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EFFECT OF FLY ASH ON GROWTH AND YIELD OF CROP PLANT

Pallavi Rai
Department of Botany, C.M.P. Degree College, Allahabad - 211002, (U.P.), India

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ABSTRACT

This study was conducted to see the effect of fly ash on growth and yield of plant. Study revealed that fly ash was most effective in growth and yield of plant.

Key words : *Fly ash, growth, yield*

Coal based thermal power stations are the major source of energy supply in India, meeting more than 55% of country's energy requirement. Indian coal is characterized by high ash content (30-50%) and consequently, a huge amount of coal combustion residues (CCRs) are produced in the country. Management of such a huge amount of CCRs is a tough task. Due to disposal of such huge amount of coal combustion residue on land cause lots of burden on land.Fly ash is disposed in two ways, wet and dry disposal system.In dry disposal method, fly ash is transported and stored in yards, which may be.

Subsequently disposed in landfills or used for other purposes.CCRs are being used in many areas from road construction to brick making, from paint manufacture to tiles making, from fill material to its use in agriculture and so on.

Fly ash is a heterogeneous mixture of amorphous and crystalline phases and is generally considered to be a ferroaluminosilicate element. Particles of fly ash can be found in the size range from .01 to 100 mm. Chemically, fly ash contains oxides, hydroxides, Carbonates, Silicates and Sulphates of Calcium, Iron, Aluminium and other metals in trace amount that is almost all the nutrients present in the soil with exception to nitrogen. The pH of fly ash ranges from 4.5 to 12.0.Fly ash also contains some growth-essential elements like K, Ca, Mg, Fe, Zn, Mo and S which promote plant growth and also alleviate the condition of nutrients deficient soils.The fly ash is not suitable for agriculture or for vegetation establishment due to its deficiency of nitrogen and phosphorus, its low soil microbial activity, and its high pH.

MATERIALS AND METHODS

Isolation and Maintenance of Phosphate solubilizing microbes

Soil dilution and plate count method was used for isolating/counting of phosphate solubilizing microbes from the rhizospheric soil of the plants growing in the vicinity of fly ash dumping site.

Experimental Design

An experiment was setup in pots under greenhouse condition to assess the performance of both the crops raised in agriculture soil which is amended with organic matter (2% w/w), different concentration of fly ash (10, 20, 30%) and inoculated with PSF. The experiment had a complete randomized design in five blocks, two treatment / block and three replicates / treatment. The treatment were as follows

BLOCK I

Agriculture soil (Control)

Agriculture soil + Phosphate solubilizing fungi (PSF)

BLOCK II

Agriculture soil + Organic matter (CN)

Agriculture soil + CN + Phosphate solubilizing fungi (PSF)

BLOCK III

Agriculture soil + CN + 10% Fly ash (FA)

Agriculture soil + CN +PSF+ 10% FA

BLOCK IV

Agriculture soil +20% FA

Agriculture soil + CN+ PSF + 20% Fly ash

BLOCK V

Agriculture soil +30% FA

Agriculture soil + CN + PSF + 30% FA

RESULTS AND DISCUSSION

Experimental Plant Material

The experimental plant materials i.e. *Vignasinensis var*. *Kanchan*which served as the unit of propagation during the experiments.

***Vignasinensis var.* kanchan (Family Leguminosae)** Cowpea is one of the principal pulses commonly used in India. The plant is a low growing, vigorously bushy or trailing annual herb, .9-1.5 m high. The leaves are trifoliate and the leaflets are cordate and dark green. The flowers are light blue. The pods are cylindrical and somewhat constricted between the seeds.

Analysis of Soil Samples and fly ash

The data of analysis of agriculture soil of Ganga basin area and fly ash has been presented in Table 1. The chemical analysis of the soil samples indicates that the soil and fly ash are highly alkaline. The pH of the soil 8.1 and fly ash 7.4.

The nutrient status of the soil appropriate for the growth of crops but nutrient status of the fly ash very poor.Organic carbon of soils 1.2% and fly ash 0.42%. The soil was very good source of phosphorus and potassium but fly ash deficient in phosphorus and potassium content.

Table 1: Physico-chemical characteristics of agriculture and fly ash

	Agriculture soil	Fly ash
Physical		
BD (g cm^{-1})	1.5	<1.0
W.H.C (%)	22-25	35-40
Chemical		
pH	8.1	7.4
Al_2O_3 (PPm)	1.0	18.7
Fe_2O_3 (PPm)	0.37	3.4
CaO (PPm)	0.39	1.54
MgO (PPm)	0.24	0.53
Na_2O (PPm)	0.008	0.05
K_2O (PPm)	232	2.5
SO_3 (PPm)	0.19	0.1
Organic carbon, %	1.2	0.42
Nutrient		
Nitrogen	24	0.030
Phosphorus	29	0.035

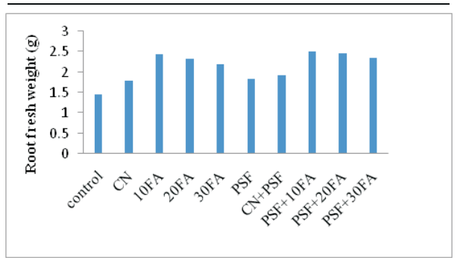

Figure 1

RESULTS AND DISCUSSION

Feeding an animal with any fodder is not enough to ensure good health and milk production, animals require a balanced diet. The most important cheap nutrients source for cattle is roughage (green fodder) but only good quality of roughage provides all the nutrients needed for dairy animals. The data regarding type of feed and system of feeding revealed that green mustard, toria, *lathyrus* species with bhusa/paddy straw, oat/berseem, dry kadbi of sudan/maize/jowar were the main feed in study area during Rabi season. Sole feeding of green forages to dairy animals is much cheaper than feeding concentrate with crop residues and has the potential of higher level of mill production (Das and Mahanta, 2010). Good quality high nutritious roughage with low concentrate is essential and economical for increasing the production and quality of milk.

On the basis of the information collected from the beneficiaries/family members it was revealed that due to lack of quality pasture lands feed and feeding practices were almost similar among the livestock owner covered under FLD, with slight change in quality and amount of forages fed to dairy animals. More than 70 percent of farm holding are marginal in our country which makes these nonviable even for arable crops and therefore the farmers are reluctant to allocate land to grow fodder crops.

The cost of feeding towards milk

Table-1: Average yield of fodder and increase in milk yield of milch animals under FLD

Year	No. of blocks	No. of villages	No. of farm-ers	Area (ha)	Av. demo. yield (qt./ ha)	Av. Milk yield 0-5 days before feeding	Av. Milk yield 30-35 days after feeding	Av. Increase in milk yield (%)	Av. rainfall in mm*	Other parameters /health condition
2004-05	4	05	10	1.0	640	2.5-4.25	3.5-5.75	37.03	0.00	+++
2005-06	4	07	15	1.0	585	2.5-4.25	4.0-6.25	34.15	4.30	+++
2006-07	5	09	15	1.0	675	2.75-4.50	4.25-6.50	32.55	119.50	++
2007-08	4	06	8	1.0	810	2.75-3.75	4.0-6.00	35.00	0.00	+++
2008-09	4	08	10	1.0	750	2.5-4.25	4.0-6.25	34.15	1.70	+++
2009-10	4	08	10	1.0	835	2.75-4.50	4.25-6.50	32.55	47.30	++
2010-11	7	10	20	2.0	595	3.50-4.50	5.25-6.75	33.33	0.00	+++
2011-12	8	12	20	2.0	600	3.25-4.75	4.75-6.75	30.44	0.00	++
2012-13	7	11	20	2.0	625	3.25-4.25	4.50-6.50	31.82	0.00	++
2013-14	8	10	20	2.0	620	3.0-4.25	4.25-6.50	32.56	161.90	+++
Total:	55	86	148	14	-	-	-	-	-	-

*Rainfall during rabi crop season October – March

to ever increasing demand for land and other inputs. Agriculture has been the backbone of Indian Economy and will continue to dominate the scene in many respects.

Krishi Vigyan Kendra's an innovative institution, also known as knowledge resource centre for farming community plays and important role in the transfer of technology to the farmers. KVK, Fatehpur functioning under the Umbrella of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur has been making its humble contribution through its various village oriented programmes and activities for improving agricultural production and providing self employment in agriculture and allied sectors. Livestock has traditionally been an integral part of our agrarian economy, consuming the crop residues and providing manure as well as animal energy for tillage and haulage.

Livestock sector has been considered an important agrarian activity for rural livelihood and employment since centuries, it still plays a crucial role in shaping the rural economy and is a major continuous income generating activity for the rural mass. India with 140 MT milk produced by its 75 million dairy farmers continues to be the largest producer of milk in the world. Uttar Pradesh, India's most populous state, with 68715147 livestock ranks Ist in livestock population and has around 1.3 million hectares area under forages (UPL). Fatehpur lies between the parallel of 35-26°. and 26-16°. north latitude and between 80-14°. and 81-20 °. east longitude spreading about 104 km from west to east and 40 km from north to south in between two holy rivers Ganga and Yamuna flowing in north and south, respectively.

MATERIALS AND METHODS

The present study was conducted in adopted villages of CSA, Krishi Vigyan Kendra, Fatehpur district of Central U.P. which falls under Central Plain (Agro-climatic) Zone-V of the state, U.P. a part of relatively more advanced regions, being the highest milk producing as well as milk consuming state of our country. The less developed district Fatehpur comprising of thirteen development blocks falling under three talukas/tehsils namely Sadar, Bindki and Khaga. Out of the total thirteen blocks, ten development blocks namely – Airayan, Hathgaon, Hanswa, Malwa, Asother, Vijaipur, Dhata, Bahua, Bhitaura and Teliyani were purposely selected for detailed investigation, collection and record of information as the first stage sampling unit, which were covered under FLD programme during the last 10 years i.e. 2004-2005 to 2013-2014. Multistage stratified random sampling technique was adopted for selection of sample household, keeping in view the farmers who were active in participating in the training programmes, field days, Gosthies, etc. organized by the KVK, were covered under FLD and provided quality (HY) seeds as critical input along with technical guidance for better yield of the fodder. The desired information from FLD farmers was collected in the purposely developed and pre-tested schedules and questionnaires through personal interview technique and observations already recorded by the concerned scientist personally during FLD visits every year. Thus the data collected from beneficiaries of eighty six villages covering ten blocks were analyzed statistically and data interpreted.

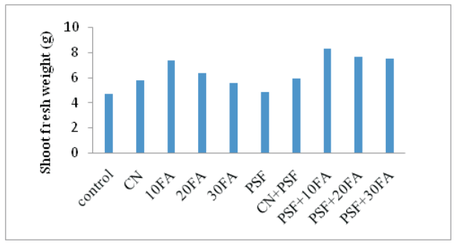

Figure 2

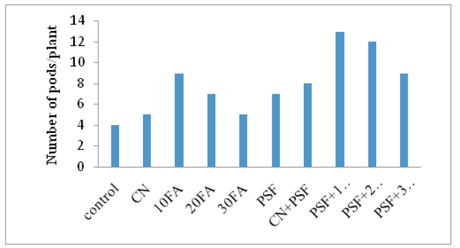

Figure 3

CONCLUSION

The root and shoot biomass of the crop, *Vignasinensis* increased tremendously with decreasing concentrations of fly ash. The crops showed maximum improvement in root and shoot biomass in 10% series amended with PSF (Figure 1, 2).Maximum yield (number of pods) in*Vignasinensis* was recorded in the 10% series which is inoculated with,PSF (figure 3). On the basis of results it was concluded that fly ash and PSF combination very effective for the growth and yield of plant.

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PERFORMANCE OF BERSEEM (*TRIFOLIUM ALEXENDRIUM*) UNDER FRONT LINE DEMONSTRATION IN FATEHPUR DISTRICT OF CENTRAL UTTAR PRADESH

Devendra Swaroop, N. Alam and Jagdish Prasad*
Chandra Shekhar Azad University of Agriculture & Technology, Kanpur,
Krishi Vigyan Kendra, Thariaon, Fatehpur-212622 (U.P.), India
Faculty of Veterinary Science and Animal Husbandry
SHIATS, Allahabad-211007(U.P.), India

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ABSTRACT

Fodders form the main stay of our livestock to decrease the competition between human-beings and animals due to ever increasing demand for land and other inputs. Feeding of green fodder in dairy animals is much cheaper than feeding concentrates with crop residues and has the potential of higher level of milk production. The present investigation was conducted to study the effect of feeding green fodder–berseem (*Trifolium alexandrnum*) along with existing traditional feeding practices of dairy animals under rabi F.L.D. programme conducted by C.S.A. Krishi Vigyan Kendra, Tharion, Fatehpur during the last ten years, i.e. 2004-05 to 2013-14.

The study revealed that berseem (Mascavi / Multicut / Vardan / Kaveri / BL-10 varieties) gave better forage yield, ranging from 585 q/ha to 835 q/ha against local check of 350 to 485 q/ha, even in sodic soil of Fatehpur. The milk yield of dairy animals 05-10 days prior to feeding, 05-10 days and 30–35 days after starting feeding berseem was observed and recorded. The average milk yield increase recorded was 37.03%, 34.15%, 32.55%, 35.0%, 34.15%, 32.55%, 33.33%, 30.44%, 31.82% and 32.56%, during FLD year 2004-05, 2005-06, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, 2011-12, 2012-13 and 2013-14, respectively. A part to increase in milk yield the health condition of the milch animals was also observed better than those who were not fed berseem.

Key words: *Berseem, forages, FLD, green fodder KVK's, livestock.*

Crop and animal husbandries are the two main components of mixed farming system, which influence our agricultural economy in the country leading to sustainable agriculture. Livestock sector has been considered important agrarian activity for rural livelihood and employment since centuries (Ghosh 2013), most often animal is the only source of cash income for subsistence farms and also serves as insurance in the event of crop failure. Fodders/forages form the main stay of our livestock to decrease the competition between human-beings and animals due

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EFFECTS OF MICROBIAL AND CHEMICAL FERTILIZERS ON VEGETATIVE AND REPRODUCTIVE CHARACTERISTICS OF TOMATO (*LYCOPESICON ESCULENTUM* LINN.) CV.RUPALI.

[1] Manoj Kumar Singh, [1]Surya Narayan, [2]Bipin Kumar and [3]S.P.Verma

1: Department of Horticulture, Kulbhasker Ashram Post Graduate College, Allahabad-211002 (U.P.)

2: Department of Plant Pathology, Kulbhasker Ashram Post Graduate College, Allahabad-211002 (U.P.)

3: Department of Animal Husbandry & Dairying , Kulbhasker Ashram Post Graduate College, Allahabad-211002 (U.P.)

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ABSTRACT

To study the influence of organic and inorganic on quality and yield components in tomato to boost the productivity potential combined application microbial and chemical fertilizers had a great influence at all the growth stages of the crop. Significant differences in all parameters like, plant height, number of leaves, leaf area and number of branches due to the combined application of microbial fertilizer and chemical fertilizer. Maximum plant height (65.23 cm) was observed in Treatment-5 containing NPK+ Phosphobacteria (each 7g / pot). The maximum number of flowers (37.25) per plant was produced in T5 treatment and the maximum number of fruits (27.25/plant). The highest number of branches per plant (26.25) was recorded in treatment T5. Highest fruit weight was observed in T5 was (122.23g) Total number of leaf observed 185.33 per plant was observed in T-5, and leaf area fairly gives a good idea of photosynthetic capacity of the plant. Significant differences were noticed with regard to leaf area index among the treatments at all growth stages.

Key words: *DAP, NPK, urea Azospirillum, Phosphobacteria, chemical fertilizer and egg plant.*

Tomato (*Lycopersicon esculentum Linn.)* is well responsive to nutrition and found to have great variability with varieties ,climatic conditions and soil fertility. It,s voracious feeder trait may be utilize to maximize productivity. It belongs to family Solanaceae. Plant is herbaceous, annual with erect or semispreading in habit. It also behaves like a herb. Tomato is popular vegetable and is native of Brasil. It can be grown throughout the year in almost all the states of India except at higher altitudes. The important tomato growing countries in the world are India, Bangladesh, Pakistan, China, Cyprus, Egypt, Japan, Philippines, Syria and Western Europe (Anon 2001). In India, major tomato producing states are Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh (Anonymous, 2004). The varieties of *tomato* show a wide range of fruit shapes ,ranging from oval or egg-shaped to long club shaped; and from white, yellow, red with varying shades . It is quite high in nutritive value and can be well compared with brinjal. Farmers may boost-up their socio-economic status by growing tomato if assured and remunerative yield obtained from this crop.

MATERIALS AND METHODS

The experiment was carried out in a Completely Randomized Block each unit Design (CRBD) at the Department of Horticulture, Kulbhasker Ashram Post Graduate College ,Allahabad during the year 2014-15. The mechanical compositions,

physical and chemical properties of experimental soil, which was used for pot culture study. The soil physical and chemical properties such as pH, Nitrogen (Jackson, 1958), Phosphorus (Jackson, 1958) and potassium (Peach and Tracey,1956) contents were analyzed. The raised seed bed of 3x1.5m size was prepared,and Tomato seeds were sown in one centimeter depth in the rows spaced at 7 cm and covered with thin layer of FYM. 25days seedlings were transplanted to the trial pot. The treatments, were T-1 DAP+ Azospirillum (7g / pot),T-2 DAP+Phosphobacteria (7g / pot), T-3 DAP+Potassium mobilizer (7g / pot),T-4 NPK Mixture +Azospirillum (10g /pot), T-5 NPK mixture +Phosphobacteria (7g / pot), T-6 NPK mixture +Potassium mobilizer (7g / pot), T-7 Urea+ Azospirillum (each 7g /pot), T-8 Urea+ Phosphobacteria (each 7g / pot), T-9 Urea+ Potassium mobilize (7g / pot), T-10 Urea (Control). (each 7g / pot) . Five plants were selected randomly from plot to record yield contributing characters. All practical managements included; mulching, weeding and other agronomic treatments were done mechanically. Irrigation was done based on plant requirements. In maturity time, fruit yield, number of fruits per plant, total plant height, shoot length, root length, number of branches per plant, number of leaves and leaf area per plant, fruit length and fruit width were measured. The collected data were analyzed statistically by F-test to examine the treatment effects and the mean differences were adjudged by Duncan sMultiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The present study was observed that the application of microbial and chemical fertilizers combined application had a great influence at all the growth stages of the crop. Significant differences in all parameters like, plant height, number of leaves, leaf area and number of branches due to the combined application of microbial fertilizer and chemical fertilizer. Maximum plant height (65.23cm) were observed in T5 (Table1). The data on shoot length (36.25cm), and root length (51.25cm) as influenced by the combination of biofertilizers and chemical fertilizers showed significant differences among the treatments at all the stages. The highest number of branches per plant (26.25nos) was recorded in treatment T5 . Highest fruit weight was observed in T5 (122.23g) Total number of leaf observed 185.33 per plant was observed in T-5,and leaf area fairly gives a good idea of photosynthetic capacity of the plant. Significant differences were noticed with regard to leaf area index among the treatments at all growth stages. The treatment 5 showed significantly higher leaf area (1720.23 cm2).The increase in leaf area index could be attributed to increased cell division and elongation resulting in increased leaf expansion, more number of leaves due to beneficial influence of biofertilizers which release growth promoting substances and enhances the availability of nitrogen. From the data it appeared that flowering and fruiting of tomato were positively influenced by sources of nutrients applied. The maximum number of flowers (37.25/plant) per plant was produced in T5 treatment and the maximum number of fruits (18.33/plant).Similar results were also reported by Naidu et al., (1999) revealed that the morphological parameters were affected significantly due to the application of different combination of organics, chemicals and biofertilizers.Nitrogen fertilizer use has played a significant role in increase of crop yield (Modhej et al., 2008). Significant increase in

Table: 6 Experimental values of Sound velocity, Density, Refractive index, Molar refraction and Computed values, Percentage deviation of Refractive index, Molar refraction for binary liquid mixture {Diglyme (x_1) + Ethyl acetate (x_2)}

x_1	u $msec^{-1}$	ρ $gmcm^{-3}$	n (exp)	R_m (exp) cm	n (cal)	R_m (cal) cm	%n	%Rm
		T=298.15K						
0.1016	1162	0.9008	1.3771	17.26	1.3699	16.96	-0.53	-1.72
0.2005	1180	0.9069	1.3820	19.21	1.3751	18.91	-0.50	-1.61
0.3016	1196	0.9125	1.3863	21.21	1.3797	20.89	-0.47	-1.50
0.4007	1211	0.9175	1.3902	23.18	1.3841	22.86	-0.44	-1.40
0.4999	1225	0.9221	1.3939	25.16	1.3881	24.83	-0.42	-1.32
0.6005	1238	0.9264	1.3972	27.17	1.3917	26.83	-0.39	-1.22
0.6994	1252	0.9303	1.4002	29.14	1.3956	28.84	-0.33	-1.01
0.8013	1264	0.9337	1.4032	31.20	1.3990	30.91	-0.30	-0.93
0.8999	1276	0.9368	1.4052	33.14	1.4023	32.93	-0.21	-0.64
		T=303.15K						
0.1016	1143	0.8947	1.3746	17.27	1.3642	16.84	-0.76	-2.48
0.2005	1160	0.9010	1.3797	19.24	1.3693	18.76	-0.76	-2.46
0.3016	1176	0.9068	1.3842	21.24	1.3740	20.74	-0.74	-2.38
0.4007	1191	0.9120	1.3883	23.22	1.3783	22.69	-0.72	-2.29
0.4999	1205	0.9167	1.3918	25.19	1.3824	24.65	-0.68	-2.15
0.6005	1218	0.9211	1.3950	27.19	1.3861	26.64	-0.64	-2.01
0.6994	1231	0.9250	1.3980	29.16	1.3897	28.63	-0.59	-1.84
0.8013	1243	0.9286	1.4014	31.24	1.3931	30.67	-0.59	-1.83
0.8999	1255	0.9371	1.4033	33.18	1.3965	32.68	-0.49	-1.50
		T=308.15K						
0.1016	1121	0.8888	1.3722	17.29	1.3576	16.68	-1.06	-3.52
0.2005	1139	0.8952	1.3771	19.24	1.3630	18.60	-1.02	-3.35
0.3016	1156	0.9012	1.3818	21.26	1.3681	20.57	-0.99	-3.22
0.4007	1171	0.9064	1.3858	23.23	1.3725	22.51	-0.96	-3.08
0.4999	1185	0.9112	1.3895	25.21	1.3766	24.46	-0.93	-2.96
0.6005	1199	0.9158	1.3929	27.22	1.3806	26.46	-0.88	-2.78
0.6994	1212	0.9198	1.3960	29.20	1.3844	28.43	-0.83	-2.61
0.8013	1224	0.9235	1.3988	31.24	1.3878	30.47	-0.79	-2.46
0.8999	1235	0.9267	1.4012	33.18	1.3909	32.45	-0.74	-2.28
		T=313.15K						
0.1016	1100	0.8827	1.3697	17.30	1.3512	16.52	-1.35	-4.51
0.2005	1119	0.8893	1.3747	19.26	1.3570	18.44	-1.29	-4.24
0.3016	1136	0.8954	1.3793	21.27	1.3621	20.41	-1.25	-4.06
0.4007	1151	0.9008	1.3834	23.24	1.3666	22.33	-1.21	-3.92
0.4999	1166	0.9059	1.3874	25.24	1.3710	24.28	-1.18	-3.78
0.6005	1180	0.9104	1.3906	27.24	1.3751	26.27	-1.11	-3.53
0.6994	1192	0.9145	1.3936	29.21	1.3786	28.22	-1.08	-3.39
0.8013	1203	0.9183	1.3964	31.25	1.3818	30.22	-1.05	-3.28
0.8999	1215	0.9216	1.3949	32.93	1.3852	32.21	-0.69	-2.18

Table:5 Experimental values of Sound velocity, Density, Refractive index, Molar refraction and Computed values, Percentage deviation of Refractive index, Molar refraction for binary liquid mixture { Diglyme (x_1) + Octane (x_2)}

x_1	u	ρ	n (exp)	R_m(exp)	n (cal)	R_m(cal)	%n	%Rm
	$msec^{-1}$	$gmcm^{-3}$		cm		cm		
		T=298.15K						
0.0946	1170	0.7167	1.3944	38.78	1.3722	36.84	-1.59	-5.02
0.2030	1175	0.7385	1.3945	38.34	1.3737	36.54	-1.49	-4.71
0.2985	1174	0.7588	1.3955	38.00	1.3734	36.10	-1.59	-4.99
0.3956	1184	0.7806	1.3957	37.54	1.3763	35.90	-1.39	-4.37
0.4955	1192	0.8040	1.3965	37.11	1.3786	35.62	-1.28	-4.02
0.5945	1199	0.8281	1.3980	36.72	1.3806	35.29	-1.24	-3.88
0.6970	1219	0.8544	1.3999	36.31	1.3863	35.22	-0.97	-3.01
0.7972	1232	0.8812	1.4013	35.86	1.3900	34.97	-0.80	-2.49
0.8977	1256	0.9092	1.4033	35.45	1.3968	34.94	-0.47	-1.44
		T=303.15K						
0.0946	1148	0.7125	1.3924	38.84	1.3657	36.47	-1.92	-6.09
0.2030	1152	0.7341	1.3922	38.37	1.3669	36.16	-1.82	-5.77
0.2985	1155	0.7543	1.3930	38.01	1.3678	35.83	-1.81	-5.74
0.3956	1163	0.7762	1.3934	37.56	1.3701	35.58	-1.67	-5.28
0.4955	1168	0.7994	1.3953	37.22	1.3716	35.23	-1.70	-5.35
0.5945	1181	0.8236	1.3957	36.73	1.3754	35.05	-1.45	-4.57
0.6970	1195	0.8497	1.3972	36.30	1.3795	34.85	-1.27	-3.97
0.7972	1218	0.8762	1.3988	35.87	1.3861	34.85	-0.91	-2.84
0.8977	1237	0.9043	1.4010	35.46	1.3914	34.71	-0.68	-2.11

plant height, number of leaves, number of branches and number of fruits due to influenced by environmental conditions and management practices. Prabhu et al., (2003) their studies indicated that plant height is increased by the application of organics and biofertilizers, attributed to the increased uptake of nutrients in the plants leading to enhanced chlorophyll content and carbohydrate synthesis and increased activity of hormones produced by *Azospirillum* and phosphate solubilizing bacteria.The Phosphobacteria increased phosphate availability in soils which in turn helped better proliferation of root growth and uptake of other nutrients to the greater extent. So that the enlargement in cell size and cell division, which might have helped in plant height, number of leaves, branches number of fruits per plant. These results are in agreement with those reports of Nanthakumar and Veeraraghavathatham(2000), Anburani and Manivannan (2002),and Wange and Kale (2004) in brinjal.Fundamentally, K+ is very water soluble and highly mobile and transported in the plants xylem (Lack and Evans, 2005). Membrane transport of potassium can be mediates either by potassium channels, utilizing the membrane potential to facilitate transport of potassium down its electrochemical gradient,or by secondary transporters . In plants,potassium act as regulator since it is constituent of 60 different enzyme systems of drought tolerance and water-use efficiency. In addition, current study has showed that to optimum growth, crops need more potassium than needed (Simonsson et al., 2007)Aminifard et al., (2010) with study responses of eggplant to different rates of nitrogen under field conditions were reported that fertilization with 100 Kg/ha nitrogen resulted in the highest average fruit weight and fruit yield. Pal et al., (2002) were reported that eggplant fruit yield increased with increase in nitrogen up to187.5 kg/ha.Only microbial treated plants could not increase the vegetative growth of plants and the reason may be that they released nutrients at a slower rate. On the other hand,the only application of inorganic fertilizer was also less effective than the combined application. These results were inconformity with the findings of Rahman etal. (1998) found that the vegetative growth and yield of berry was the highest with the combined application of manures andfertilizers. For eggplant, the integrated useof urea and poultry manure also resulted in a higher nutrient uptake Jose et al., (1988).The use of synthetic fertilizers causes a great impact on the environment and the cost ofthese fertilizers is increasing over the years.The farmers need to raise the crops by organic farming that will reduce the costs and will decrease the impact on the environment.

In addition, organic farming will reduce the additional burden of environmental pollution that is caused while manufacturing these synthetic fertilizers at the source (Rathier and Frink, 1989). Now it is a well established fact that organic fertilizers provide enough requirements for proper growth of the crop plant and may enhance the uptake of nutrients, increase the assimilation capacity and will stimulate the hormonal activity as well (Tomati et al., 1990). The use of biofertilizers useful as it increases soil porosity, aeration and water holding capacity, therefore a practically paying proposal. Azospirillum, a nitrogen fixing organism has been reported to be beneficial and economical on several crops.They improve the growth and yield as well as productivity of the crop. Vanangamudi et al., (1989) also reported similar increase in per cent germination and shoot length of chilli with increase in nitrogen

application (0 150 kg/ha). Prabhu et al. (2003) reported that increased N and P rates increased the plant height, branch number per plant in brinjal phosphate solubilizing Bacteria (PSB) are a group of beneficial bacteria capable of hydrolysing organic and inorganic phosphorus from insoluble compounds. Chen et al., (2006) P-solubilization ability of the microorganisms is considered to be one of the most important traits associated with plant phosphate nutrition P-solubilizers are biofertilizers which solubilizes the fixed phosphorus in soil and makes it available for plants. The microbes, *Fraturia aurantia* belonging to the family *Pseudomonaceae*, is a beneficial bacteria capable of mobilizing potash to plants in all types of soil especially, low K Content soil. Such bacterial population in the soil form can increase the availability of potash to the plants. Wange and Kale (2004) reported that, the results

Table.1 The effect of microbial and chemical fertilizer on vegetative characteristics of tomato plant. cv.Rupali.

Treatments	Plant height(cm)	Shoot length (cm)	Shoot /plant(no)	Leaves/plant (cm)	Leaf area/plant (cm2)	Root/plant (no)	Root length (cm)
T_1	50.11	20.01	12.21	120.12	1110.21	11.20	30.25
T_2	52.33	22.41	14.24	142.01	1320.25	13.22	32.22
T_3	51.12	21.01	13.21	130.11	1201.22	12.02	31.02
T_4	62.21	32.01	23.10	162.21	1500.20	22.23	52.36
T_5	65.23	36.25	26.25	185.33	1720.23	25.14	55.65
T_6	61.51	33.41	24.00	154.00	1445.01	23.02	51.25
T_7	45.44	30.00	9.25	95.33	950.23	8.35	35.36
T_8	48.25	31.02	10.23	100.23	1000.25	9.36	38.44
T_9	46.21	29.22	9.89	96.65	960.56	8.55	36.25
T_{10}	36.23	15.64	5.54	55.65	565.85	4.56	25.68
MSE+_	8.25	4.22	2.14	12.02	45.36	1.20	3.36

Table:4 Experimental values of Sound velocity, Density, Refractive index, Molar refraction and Computed values, Percentage deviation of Refractive index, Molar refraction for binary liquid mixture { Diglyme (x1) + Heptane (x2)

x_1	u	ρ	n (exp)	R_m (exp)	n (cal)	R_m (cal)	%n	%Rm
	$msec^{-1}$	$gmcm^{-3}$		cm		cm		
		T=298.15K						
0.0978	1136	0.7016	1.3861	34.66	1.3621	32.73	-1.73	-5.57
0.1970	1146	0.7254	1.3870	34.68	1.3651	32.93	-1.58	-5.06
0.2958	1141	0.7502	1.3896	34.79	1.3636	32.71	-1.87	-5.97
0.3834	1145	0.7720	1.3908	34.81	1.3648	32.74	-1.87	-5.95
0.4946	1167	0.8004	1.3929	34.86	1.3713	33.15	-1.55	-4.90
0.5940	1170	0.8271	1.3957	34.92	1.3722	33.07	-1.68	-5.30
0.6956	1206	0.8541	1.3978	34.94	1.3826	33.76	-1.08	-3.39
0.7955	1213	0.8812	1.4003	34.99	1.3846	33.77	-1.12	-3.48
0.8992	1238	0.9085	1.4031	35.09	1.3917	34.21	-0.81	-2.50
		T=303.15K						
0.0978	1101	0.6972	1.3838	34.70	1.3515	32.07	-2.33	-7.57
0.1970	122	0.7210	1.3847	34.71	1.3579	32.54	-1.93	-6.25
0.2958	1114	0.7455	1.3870	34.80	1.3555	32.26	-2.27	-7.32
0.3834	1121	0.7673	1.3889	34.87	1.3576	32.35	-2.25	-7.22
0.4946	1145	0.7954	1.3906	34.89	1.3648	32.83	-1.85	-5.91
0.5940	1164	0.8223	1.3933	34.93	1.3704	33.12	-1.64	-5.19
0.6956	1177	0.8491	1.3956	34.98	1.3742	33.29	-1.53	-4.81
0.7955	1205	0.8767	1.3979	34.98	1.3824	33.76	-1.11	-3.48
0.8992	1220	0.9054	1.4009	35.04	1.3866	33.93	-1.02	-3.16

Table:3 Experimental values of Sound velocity, Density, Refractive index, Molar refraction an Computed values, Percantage deviation of Refractive index, Molar refraction for binary liquid mixture {Diglyme(x_1) + Hexane (x_2)}

x_1	u $msec^{-1}$	ρ $gmcm^{-3}$	n (exp)	R_m (exp) cm	n (cal)	R_m (cal) cm	%n	%Rm
		T=298.15K						
0.1017	1082	0.6903	1.3782	30.42	1.3456	28.06	-2.36	-7.76
0.2006	1098	0.7187	1.3810	30.94	1.3506	28.72	-2.20	-7.18
0.3006	1115	0.7480	1.3838	31.42	1.3558	29.36	-2.02	-6.56
0.3974	1138	0.7752	1.3869	31.94	1.3627	30.15	-1.74	-5.60
0.4984	1153	0.8040	1.3909	32.50	1.3672	30.74	-1.70	-5.43
0.5986	1179	0.8322	1.3938	32.98	1.3748	31.57	-1.36	-4.30
0.6954	1203	0.8588	1.3968	33.48	1.3818	32.35	-1.08	-3.37
0.8011	1236	0.8878	1.4013	34.09	1.3912	33.33	-0.72	-2.24
0.8957	1261	0.9137	1.4036	34.50	1.3981	34.09	-0.39	-1.20
		T=303.15K						
0.1017	1066	0.6857	1.3753	30.42	1.3456	27.88	-2.52	-8.34
0.2006	1082	0.7139	1.3786	30.94	1.3506	28.54	-2.39	-7.85
0.3006	1098	0.7432	1.3814	31.42	1.3558	29.16	-2.23	-7.27
0.3974	1117	0.7704	1.3848	31.94	1.3627	29.86	-2.05	-6.63
0.4984	1135	0.7989	1.3886	32.50	1.3672	30.53	-1.93	-6.18
0.5986	1159	0.8273	1.3911	32.98	1.3748	31.31	-1.59	-5.06
0.6954	1182	0.8539	1.3944	33.48	1.3818	32.07	-1.34	-4.23
0.8011	1214	0.8829	1.3978	34.09	1.3912	33.04	-0.92	-2.88
0.8957	1239	0.9088	1.4012	34.50	1.3981	33.80	-0.66	-2.03

revealed significant improvement in vegetative characters such as plant height and number of leaves per plant in brinjal over the recommended biofertilizer with combine chemical fertilizer. The information on the role of organics on morphophysiological traits in brinjal is meager. Hence, there is a need to study the influence of organic and inorganic on quality and yield components in brinjal to boost the productivity potential.

The cost of inorganic fertilizers has been enormously increasing to an extent that they are out of reach of the poor, small and marginal farmers. It has become impractical to apply such costly inputs for a crop of marginal returns. The use of biofertilizers in such situation is therefore a practically paying proposal. Based on the above results, it was concluded that, the application of microbial and chemical fertilizers was found more beneficial and significantly improved morpho-physiological traits, growth parameters, and yield components in tomato. The benefit cost ratio was found lesser in using both biofertilizer and chemical fertilizer compared to using chemical fertilizer alone in tomato crop cultivation.

Table.2 The effect of microbial and chemical fertilizer on reproductive characteristics of tomato plant. cv.Rupali.

Treatments	Anthesis time (DAP)	Flower/plant (no)	Fruit setting/plant (no)	Fruit /plant (kg)	Single Fruit weight (g)	Fruit yield/plant (kg)	Fruit yield (Q/ha)
T_1	70.11	21.01	13.21	10.12	60.21	1.100	330.25
T_2	72.33	23.41	15.24	142.01	82.25	1.320	332.22
T_3	71.12	22.01	14.21	13.11	70.22	1.200	331.02
T_4	66.21	33.01	24.10	16.21	100.20	2.230	552.36
T_5	65.23	37.25	27.25	18.33	122.23	2.540	555.65
T_6	66.51	34.41	25.00	15.00	114.01	2.320	551.25
T_7	75.44	31.00	10.25	9.33	95.23	0.830	335.36
T_8	78.25	32.02	11.23	10.23	100.25	0.930	338.44
T_9	76.21	30.22	10.89	9.65	36.56	0.850	336.25
T_{10}	96.23	16.64	6.54	5.65	16.85	0.456	225.68
MSE+_	9.25	5.22	3.14	1.02	4.36	0.120	33.36

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liquids, halogen containing polar organic liquids, cyclic hydrocarbon liquids are listed in tables 1 & 2 respectively show that for considered pure liquids the percentage deviation between calculated and experimental value of refractive index and molar refraction from equation (2) & (3) respectively increases as the temperature increases. The percentage deviation of refractive index and molar refraction for benzene are larger while that of diglyme (diethylene glycol dimethyl ether) are smaller in comparison to other considered liquids.

A perusal of results of tables 3, 4, 5, 6, 7, 8 & 9 show that as the temperature increases the percentage deviation of computed values of refractive index and molar refraction respectively increases. Again, as the mole fraction of diglyme increases, the percentage deviations of n and R_m decreases. From the results of the tables mentioned above (3-9) it appears that as the mole fraction of heptane increases and the mole fraction of n-hexane in binary mixture decreases, the percentage deviation of computed and measured n and R_m from equations (2) and (3) decreases. It is clear from the results that as the mole fraction of n-hexane increases, the percentage deviation of experimental values and calculated values of n and R_m from equations (2) and (3) increases. The percentage deviation of computed values of refractive index and molar refraction for Diglyme + Diethyl Succinate are minimum 1.23 and 3.79 respectively.

Table : 2 Experimental values of Sound velocity, Density, Molar refraction, Refractive index and computed values, Percentage deviation of Refractive index, Molar refraction for Polar & Non-Polar Liquids

Liquid	T	u	ρ	n (exp)	R_m (exp)	n (cal)	R_m (cal)	%n	%Rm
	K	$msec^{-1}$	$gmcm^{-3}$		cm		cm		
Ethyl acetate	298.15	114	0.8939	1.3719	15.25	1.3627	14.93	-0.63	-2.09
(M=60.05)	303.15	112	0.8878	1.3690	15.26	1.3562	14.78	-0.94	-3.13
	308.15	109	0.8814	1.3662	15.27	1.3485	14.60	-1.29	-4.35
	313.15	107	0.8751	1.3637	15.28	1.3414	14.44	-1.63	-5.53
	318.15	105	0.8687	1.3612	15.30	1.3345	14.28	-1.96	-6.69
Diethyl succinate	298.15	132	1.0353	1.4196	42.54	1.4121	41.87	-0.53	-1.58
(M=174.2)	303.15	130	1.0299	1.4173	42.56	1.4072	41.66	-0.71	-2.12
	308.15	127	1.0246	1.4152	42.59	1.4002	41.23	-1.06	3.20
	313.15	126	1.0189	1.4133	42.66	1.3966	41.13	-1.18	-3.58
	318.15	124	1.0140	1.4115	42.7	1.3907	40.79	-1.47	-4.47
Dietylene glycol	298.15	128	0.9396	1.4074	27.83	1.4034	27.59	-0.28	-0.86
(M=106.12)	303.15	126	0.9346	1.4055	27.86	1.3971	27.35	-0.60	-1.83
	308.15	124	0.9295	1.4034	27.88	1.3919	27.18	-0.82	-2.54
	313.15	122	0.9244	1.4009	27.89	1.3860	26.96	-1.07	-3.31
	318.15	120	0.9193	1.3992	27.93	1.3814	26.83	-1.27	-3.97

$$n = \frac{u_1}{u_2} \quad \text{.....(1)}$$

Where u_1 and u_2 are the velocities of light waves in medium 1 and 2 respectively. From the experimental results by trial and error method it is found that the refractive index (n) of liquid system can be expressed as

$$n = u^{1/4} / u_0^{1/4} \quad \text{.....(2)}$$

Where u and u_0 are the velocity of sound in liquid at given temperature and in air at 0^0C respectively. Molar refraction (R_m) is defined as

$R_m = \{(n^2-1) / (n^2+2)\}\{M / \rho\} = \{(n^2-1) / (n^2 + 2)\}\{V\}$ .....(3)

RESULTS AND DISCUSSION

Equation (2) and (3) have been employed to compute the values of refractive index and molar refraction for pure liquids, binary liquid mixtures and three ternary liquid mixtures. The experimental values of sound velocity and density needed for computing refractive index and molar refraction were collected from different sources give alongwith tables.

The results of primary and secondary amines, ternary amines, aliphatic hydrocarbon

Table: 1 Experimental values of Sound velocity, Density, Molar refraction, Refractive index and Computed values, Percentage deviation of Refractive index, Molar refraction for Primary & Secondary Amines

Liquid	T K	u $msec^{-1}$	ρ $gmcm^{-3}$	n (exp)	R_m (exp) cm	n (cal)	R_m (cal) cm	%n	%Rm
Hexyl-amine	298.15	130	0.7612	1.4198	33.63	1.4089	32.86	-0.77	-2.29
(M=101.19)	303.15	128	0.7572	1.4168	33.59	1.4026	32.59	-1.00	-3.00
	308.15	126	0.7531	1.4139	33.57	1.3966	32.33	-1.23	-3.70
	313.15	124	0.7490	1.4109	33.54	1.3905	32.06	-1.45	-4.41
	318.15	121	0.7450	1.4081	33.51	1.3843	31.77	-1.69	-5.19
	323.15	119	0.7410	1.4051	33.48	1.3783	31.50	-1.91	-5.90
Octyl-amine	298.15	136	0.7794	1.4281	42.68	1.4232	42.25	-0.34	-1.01
(M=129.25)	303.15	133	0.7756	1.4261	42.71	1.4166	41.87	-0.67	-1.96
	308.15	131	0.7719	1.4241	42.74	1.4099	41.48	-0.99	-2.94
	313.15	128	0.7681	1.4221	42.77	1.4032	41.08	-1.33	-3.95
	318.15	126	0.7644	1.4201	42.80	1.3966	40.68	-1.66	-4.95
	323.15	123	0.7606	1.4182	42.84	1.3896	40.25	-2.02	-6.06
Decyl-amine	303.15	135	0.7874	1.4305	51.68	1.4206	50.64	-0.7	-2.02
(M=157.36)	308.15	133	0.7838	1.4283	51.69	1.4155	50.33	-0.89	-2.61
	313.15	131	0.7802	1.4262	51.70	1.4097	49.94	-1.16	-3.41
	318.15	129	0.7763	1.4242	51.75	1.4051	49.69	-1.34	-3.97
	323.15	127	0.7730	1.4231	51.85	1.3991	49.25	-1.69	-5.02
Dodecyl-amine	303.15	138	0.7949	1.4377	61.18	1.4294	60.17	-0.58	-1.65
(M=185.36)	308.15	136	0.7913	1.4357	61.21	1.424	59.77	-0.82	-2.36
	313.15	134	0.7880	1.4326	61.09	1.4185	59.34	-0.99	-2.87
	318.15	132	0.7844	1.4303	61.08	1.4126	58.88	-1.24	-3.61
	323.15	130	0.7810	1.4282	61.09	1.407	58.42	-1.49	-4.36

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EVALUATION OF REFRACTIVE INDEX (n) AND MOLAR REFRACTION (R_m) FROM SONIC VELOCITY AND MOLAR VOLUME

J. D. Pandey, Rupali Sethi and Anjani K. Singh
Department of Chemistry, University of Allahabad,
Allahabad - 211002, (U.P.), India

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ABSTRACT

The use of refractive index and prediction of structure of a liquid or its mixture with the help of molar refraction and molar connectivity of pure and binary liquid mixtures is highlighted with the help of numerous parameters.

Keywords : *Refractive index, molar refraction, refractometer*

The knowledge of refractive indices plays an important role in understanding the nature of molecular interaction in liquids and their mixtures. The physicochemical behavior of liquids and solutions can also be studied using refractive index. The structure of a liquid or its mixture can be easily predicted with the help of molar refraction and molecular connectivity which can be evaluated from the knowledge of refractive index of the system. The refractive index of pure liquids and solution has been measured by different workers using different refractometers [1 to 9]. From time to time various mixing rules for the theoretical prediction of refractive index of liquid mixtures have been proposed. These include the relations due to Arago and Biot [10], Date and Gladstone [11], Lorentz and Lorenz [12,13] Eykman [14], Weiner [15], Heller [16], Newton [17], Oster [18], Eyring and John [19]. The physical basis of all these binary mixing rules is common. These relations were applied to binary liquid mixtures by Aminabhavi [20] and Pandey et al [21]. Molar refraction of liquids and liquid mixtures (binary, ternary and quaternary) has been evaluated by different workers during recent years using these mixing rules.

It is worthwhile to establish a relation between refractive index and sound velocity in case of liquids and solution. It appears that no such attempt has been made in literature. On the basis of this relation refractive index and molar refraction of pure liquids and their mixtures (binary, ternary, quaternary) have been computed purely from the knowledge of their sound velocity. The calculated values of the refractive index and molar refraction of the aforesaid system are compared with the experimental findings. It has been demonstrated that the proposed relation yields quite satisfactory results for all the systems undertaken for the present investigation.

MATERIALS AND METHODS

According to Snell's law the refractive index of medium (2) relation to medium (1) is defined as

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FOOD AND FEEDING HABIT OF LABEO CALBASU (HAM.) FROM THE RIVER GOMTI AT SULTANPUR, U.P.

P.R. Singh
Zoology Department, University of Allahabad - 211002 (U.P.), India

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ABSTRACT

Labeo calbasu, the black rohu is an important fish species commonly found in the river Ganga and its tributaries. In comparison to popular Indian major carps the calbasu is hardy fish species and inhabiting in a variety of aquatic habitats. The fish fed mainly on decomposed animal and plant materials found in the riverine bed. Diatoms were recorded in the gut content throughout the year. A variety of algae were also recorded. Higher percentage of sand and mud in the gut content and fringed mouth showed the bottom feeding habit of the fish. Gastro-somatic index values were recorded higher during winter months and the minimum values were recorded during monsoon months. The fish species is euryphagous in nature and fed on wide variety of good substances.

Keywords: *Feeding habit. gut cotents, Labeo calbasu, riverine environment.*

Specimens of Labeo calbasu were collected from the landing sites near Golaghat Bridge throughout the year and morphometric and meristic characters were recorded. Two to three specimens were available per day at this site. Study of food and feeding habits of fishes is very important aspect of fishery biology and is directly related to growth of fishes and the affecting the yield of aquatic ecosystems. With the knowledge of food and feeding habits of fishes we can have a better feed formulation we can enhance the fish production of aquatic ecosystems. Knowledge of conversion rates of the different food items is also helpful for the same. A number of workers (S.L. Hora, 1943, Fish G.R. 1951, .V. Natrajan and A.G. Jhingran, 1963, H.R. Singh and S.N. Bahuguna, 1983, Z.L. Liu and A. Herzing, 1996) have studied the food and feeding habits of a variety of fishes in different ecosystems. Food and feeding habit of Labeo calbasu were also worked out by a number of workers (P. Sehgal, 1966, G.M. Sinha, 1976. G.K. Vinci and V.V. Sugnan, 1981. M.A. Khan, 1988, P.R. Singh and H.R. Singh, 2000) and indicated that the fish species is a bottom feeder and fed on a variety of food items.

MATERIALS AND METHODS

Specimens of Labeo calbasu were collected from the landing site of the river Gomti near Golaghat Bridge at Sultanpur. After a record of morphometric and meristic characters fish were cut open and gut mainly the intestinal bulbs were fixed in 8 percent formalin solution for further examinations in the laboratory. Relative lengths of the gut (R.L.G.) were calculated by the following formula:

RLG = total length of the gut/total length of the fish Feeding intensity was recorded with the help of Gastrosomatic index (GaSI) values.

GaSI - weight of intestinal bulb contents/weight of the fish x 100

For calculation of different food items the point methods of Swynnerton and Worthington (1940) as reviewed by Hynes (1950) and Pillay (1952) were adopted. The various food items in the fresh conditions were identified with help of identification methods of Needham and Needham (1962) and Ward and Whipple (1959).

RESULTS AND DISCUSSION

On the basis of qualitative and quantitative analysis and microscopic identification of different food items during year 2006 for all the 12 months the food items were categorized in the following way:-

(a) Semi decomposed organic matter: The most abundant food material was recorded in the intestinal bulb for all the months i.e. January to December. The major bulk of food comprised of organic detritus contributed more than 70 percent.

(b) Diatoms: Diatoms were recorded in the gut contents throughout year for all 12 months. These were represented by Synedra, Navicula, Fragilaria, Nitzshia etc. The percental contribution was recorded 0.5 to 2 percent.

(c) Green algae, Desmids, Macrophytes and other miscellaneous items: On the basis of gut content analysis, the miscellaneous items were recorded 1 to 10 percent. Zygnema, Spirogyra, Closterium, Filamentous microphytes, hard parts of animals etc. were identified.

(d) Sand and Mud: The calbasu is a bottom feeding fish and obviously high percentage of sand and mud were recorded in the gut content. The percental value was recorded up to 25 percent.

GaSI values were recorded higher during winter months which may be due to high amount of food availability and were recorded low during monsoon months and summer months which may be attributed to non availability of food items. A high value of RLG indicated that fish depends upon plant detritus mainly.

Table:1 Monthly variation in percental value of major food items

Percentage of food items				
Months	*(a)*	*(b)*	*(c)*	*(d)*
Jan	*75.0*	*2.0*	*3.0*	*20.0*
Feb	*70.0*	*1.5*	*8.5*	*20.0*
Mar	*80.0*	*1.0*	*9.0*	*10.0*
Apr	*75.0*	*1.5*	*9.5*	*19.0*
May	*70.0*	*1.5*	*8.5*	*20.0*
Jun	*70.0*	*2.0*	*8.0*	*20.0*
Jul	*75.0*	*1.5*	*8.5*	*20.0*
Aug	*65.0*	*1.0*	*9.0*	*25.0*
Sep	*67.0*	*0.5*	*8.5*	*24.0*
Oct	*69.0*	*0.5*	*9.5*	*19.0*
Nov	*70.0*	*1.5*	*10.0*	*18.5*
Dec	*71.0*	*1.0*	*8.5*	*19.5*
Average	*71.41*	*1.29*	*8.37*	*19.583*

posterior extremity.

Etymology :- On the basic of all the above variable parameters present species was named *H.andersonii* in the honour of famous, parasitologist Prof. R.M. Anderson of U.K.

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Plate-2

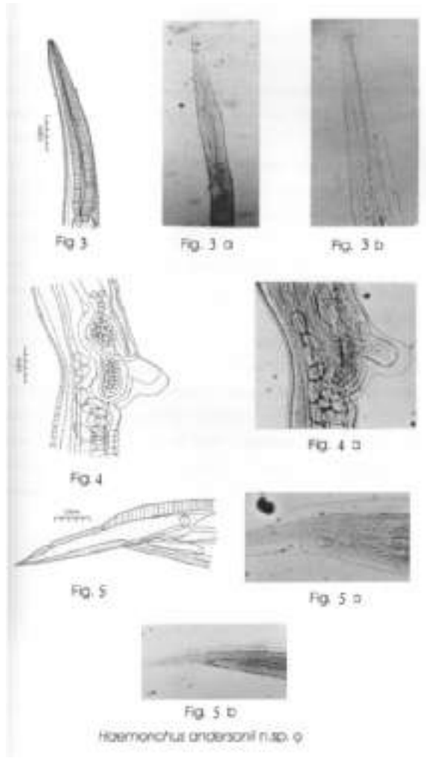

Fig. 3- Camera lucida diagram of *Haemonchus andersonii n.sp.* female anterior region in 100X.
Fig. 3a- Microphotograph of *Haemonchus andersonii n.sp.* female anterior region in 75X.
Fig.3b- -Microphotograph of *Haemonchus andersonii n.sp*. female anterior region in 300X.
Fig. 4 - Camera lucida diagram of *Haemonchus andersonii n.sp.* female vulval region in 100X.
Fig. 4a- Microphotograph of *Haemonchus andersonii n.sp.* female vulval region in 300X.
Fig. 5- Camera lucida diagram of *Haemonchus andersonii n.sp.* female tail region in 100x.
Fig.5a-Microphotograph of *Haemonchus andersonii n.sp*. femail tail region in 150X.
Fig. 5b- Microphotograph of *Haemonchus andersonii n.sp.* female vulval region in 75X.

was 0.334- 0.335 (0.335) mm from posterior extremity. Structure of mouth buccal cavity were same as in male but differed in size from male. (Plate-12: Figure- 27 , 27a, 27b, 28, 28a, 29, 29a, 29b; Table-9).

Taxonomic summary:- The holotype males and females along with paratype deposited in the Parasitology Laboratory of the department of Zoology, C.C.S.University, Meerut , India.

Type locality :- Local slaughter houses of Meerut region.

Host :- Sheep

Site of location in host:- Intestine

Remarks:- *Haemonchus andersonii n.sp.* comes closer to *Haemonchus contortus*. *H.andersonii n.sp.* male measured 13.28- 13.35 mm in length where as the males of *H.contortus* measured 10-20 mm 11.11- 11.37 (11.24) mm in length respectively. Females of *H. Conturtus* measured 18-30 mm in length. Females of present species measured 18.79- 19.79 919.29) mm long. Length of oesophagus was 1.035- 1.037 (1.036) mm and 1.0187-1.0189 (1.019) mm from anterior end in male and female respectively. Whereas oesophagus of male and female of *H. contortus* was 1.2- 1.5 mm in male and female of *H. andersonii n.sp.* respectively.

In present species right and left spicules measured 0.384- 0.396 (0.39) mm in length. Whereas hooks of left and right spicule were 0.005- 0.006 (0.055) mm and 0.067- 0.069 (0.068) mm respectively.

In *Haemonchus conturtus* spicule was 0.300- 0.500 mm long and hooks measured 0.44 mm and 0.24 mm long in left and right mm long.

Vulval was situated at a distance of 3.173 – 3.174 (3.174) mm from posterior extremity in present species, where as Vulva of *H.conturtus* was situated at a distance of 3-4 mm from

Table:2 GaSI and RLG Values of *Labeo calbasu*

Months	*No. of fishes examined*	*GaSI*	*RLG*
Jan	*3*	*0.99*	*8.23*
Feb	*2*	*1.12*	*7.55*
Mar	*3*	*1.13*	*8.36*
Apr	*4*	*1.01*	*7.54*
May	*4*	*0.81*	*8.26*
Jun	*2*	*0.72*	*8.55*
Jul	*3*	*0.52*	*7.43*
Aug	*1*	*0.45*	*8.19*
Sep	*1*	*0.32*	*8.34*
Oct	*2*	*0.40*	*7.98*
Nov	*3*	*0.84*	*7.57*
Dec	*3*	*0.95*	*7.93*

Singh (2015) recently recorded the fish biodiversity of river Gomti and reported approximately 35 fish species and found that calbasu is an important constituent in the riverine environment. Study of food and feeding habit is very important in fisheries management practices. The correct feed formulation may enhance the fish production in aquatic bodies. Pillay (1952) gave a new idea of point method for the different food items. Hora (1943) observed that in what way with study of the feeding habits the fish production is enhanced. The composite cultures were evolved to utilize all the strata of aquatic bodies with best combination of different fish species. Singh and Singh (2000) observed the feeding biology of the same species inhabiting the river Ganga and found that fish fed mainly on detritus, diatoms and other algae. The feeding intensity was recorded higher during winter months and lower during summer months due to heavy growth of gonads.

In the present study it is found that fish is a bottom feeder and mainly subsisting on the semi decomposed organic materials. A variety of diatoms, desmids and algae were also found in the gut content. The high percentage of sand and mud also indicated that fish is benthophagus in nature. Thus fish inhabiting the river Gomti is a euryphagous species and fed on a variety of food items.

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Length of left side and right hooks were 0.05-0.06 (0.055) mm from posterior extremity.

Both the lobes of bursa were distinct having finally cuticular muscular rays. Right lobe of bursa contained ventro-ventral and latero-ventral rays but upwardly and medio-lateral, externo-lateral and poste-rior lateral rays were straight and reaching up to the margin of bursa. Dorsal ray was also in left side and externo-dorsal ray was straight.

Spicules were iso-spiculus bent towards left lobe of bursa. Left externo-dorsal ray was straight whereas left ventro-ventral ray and latero-ventral rays were slightely curved at the tip where as medio-lateral ray was straight, other ray like externo-lateral and posterior-lateral rays were bent slightely upwardely.

Females- The femals were cylindrical, filliform, pointed anteriorly, having slight cephalic inflation and backwardly directed. Oesophagus was bent at two places. One, near papillae and other below cervical papillae. Cadual inflation was well deve-loped. Well developed cuticular annula-tions were observed in middle of the body and near valvular process. Valvular process was bent backwardly posterior to vulva. Eggs were observed in ovijector.

Length of female parasite was 18.79-19.79 (19.29) mm and maximum width was 0.198-0.199 (0.199) mm. Length of buccal cavity was 0.0167-0.0169 (0.017) mm and width of buccal cavity was 0.008- 0.009 (0.009) mm. Length of oesophagus from anterior extremity was 1.0187-1.0189 (1.019) mm and width of oesophageal bulb was 0.084-0.085 (0.085) mm. Nerve ring from anterior extremity was 0.234- 0.235 (0.235) mm. Cervical pappilae were 0.334- 0.335 (0.335) mm from anterior extremity. Length of oesophagus was 1.0187-1.0189 (1.019) mm and width of oesophageal bulb was 0.084- 0.085 (0.085) mm. Nerve ring from anterior extremity was 0.234-0.235 (0.235) mm. Vulva was 3.173- 3.174 (3.174) mm from posterior extremity and length of vagina was 0.0501- 0.0601 (0.055) mm. Anus

Plate-1

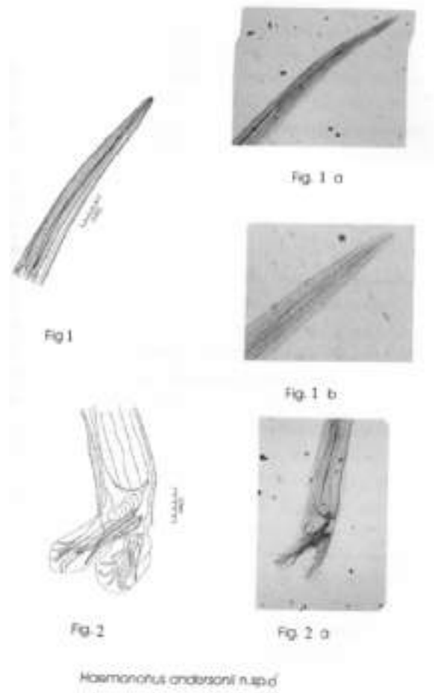

Fig. 1- Camera lucida diagram of *Haemonchus andersonii n.sp.* male anterior region in 100X.
Fig. 1a- Microphotograph of *Haemonchus andersonii n.sp*. male anterior region in 75X.
Fig. 1b- Microphotograph of *Haemonchus andersonii n.sp.* male anterior region in 150X.
Fig. 2 & 2a- Camera lucida Microphotograph of *Haemonchus andersonii n.sp.* male posterior region in 75X.

followed by Camera lucida made diagrams for biodiversity studies. Morphometery was done by occulometer and stage micro-meter. Biodiversity study was done by consulting Fauna of British India (Baylis H.A., 1939), Parasites of Domesticated Animals (Norman, D. Levine,1968) and CIH keys to the Nematode Parasites of Vertebrates (ROY, C. Anderson and Alain, G. Chaubad, 1983).

RESULTS AND DISCUSSION

The morphometric observations were made on basis of taxonomic keys given by Anderson and Chaubad has been modified to identify new species belonging to Genus *Haemonchus* and Sub-family- Tricho-strongylinae (Haemonchinae- Neodont formation).

- Dorsal lobe reduced and asymmetrical - *H. contortus*
- Externolateral and posterolateral rays reaching upto Bursa -*H. andersonii* ***n.sp.***
- Spicules and hooks smaller- *H. andersonii* ***n.sp. Haemonchus andersonii*** **n.sp.**

General Characters: - The specimens of *Haemonchus andersonii n.sp.* were collected from local slaughter houses. These parasites belonged to Phylum- nemathelminthes (nematoda), Class-Secernentasida, Order-Strongylorida and Family –Trichostrongy-lidae and Sub-family- Trichostrongylinae

The parasites obtained were filliform, cylindrical, roundworm .Males and females were easily recognized by the presence of bursa in males and pointed tail in females. The body of these parasites was covered by cuticle having fine transverse annula-tions and divided into anterior, middle and posterior regions. Anteriorly it contained three conspicuous lips, one dorsal and two sub-ventral. Buccal cavity also contained a very small conical tooth in central position and each lip contained a very small papillae in central position.

Mouth opened into cylindrical oesophagus somewhat narrow anteriorly and broad posteriorly. Oesophagus contained a cuticular narrow lumen. On both side of the lumen compact radial muscles were distinct and two sub-ventral oesophageal gland were also observed which opened into buccal gland.

Oesophagus opened into intestine with two flaps like projection which prevented backward flow from intestine. Intestine occupied maximum part of body containing granular content and opened into anus by rectum in females and cloaca in males. Bilateral cephalic inflation was also observed. Cervical papillae were well developed and backwardly directed and flap like in structure. Vulva was slightly bent towards posteriorly. (Plate-1 and 2; Figures-1, 1a, 1b, and Fig. 2, 2a, 3, 3a, 3b; Fig. 4, 4a; Fig. 5, 5a, 5b).

Males:- The males measured 13.28-13.35 (13.22) mm in lenth and in width it was 0.267-0.269 (0.268) mm. Buccal cavity measured 0.015-0.017 (0.016) mm in lenth and width was 0.010-0.012 (0.011) mm. Length of oesophagus was 1.035-1.37 (1.036) mm from anterior extremity and width of oesophageal bulb was 0.084-0.086 (0.085) mm. The nerve ring was 0.251-0.252 (0.252) mm from anterior extremity and cervical papillae were 0.317-0.319 (0.318) mm from anterior extremity. Length of bursa was 0.43-0.46 (0.47) mm and 0.43-0.46 (0.47) respectively. Length of left and right spicule was 0.384-0.396 (0.39) mm and 0.384-0.396 (0.39) mm respectively. Length of left and right hooks were 0.05-0.06 (0.55) mm and 0.067-0.069 (0.068) mm respectively.

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TOXIC EFFECT OF LEAD (PB) ON SEED GERMINATION AND SEEDLING GROWTH OF WHEAT (*TRITICUM AESTIVUM L.*)

Preeti Singh
Department of Botany
S. S. Khanna Girls' Degree College, University of Allahabad, Allahabad (U.P.), India

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ABSTRACT

Wheat (*Triticum aestivum L.*) is the second most important crop in India next to rice. A huge portion of the total cultivated area in the country is under the production of wheat crop. The experiment was performed to study the seed germination and seedling growth in wheat under the influence of different concentrations of Lead. The germination %, and seedling growth decreased with the increase in lead concentrations (10^{-5}M , 10^{-4}M , 10^{-3}M, and 10^{-2} M).

Key words*: Lead, germination, radicle, plumule*

Soil contamination by industrial effluents loaded with toxic heavy metals has raised a new threat to agriculture. These effluents and wastes contain heavy metals in sufficient amount to cause toxicity to crop plants. Toxic heavy metals have no function to organism and can be highly toxic when their concentrations are exceeded threshold value. Other heavy metals at low doses are essential micronutrients for plants, but in higher doses they may cause metabolic disorders and growth inhibition for most of the plants species. Lead (Pb), unlike some other heavy metals, is not essential for higher plants and other organisms. At higher concentrations, Pb is highly toxic to man, animals and plants, which is why it is considered a dangerous pollutant. The main sources of lead entering an ecosystem are primarily from automobile emissions, fertilizers, pesticides, paint chips, used ammunition and lead-acid batteries or other industrial products. The transport and distribution of lead from major emission sources, both fixed and mobile, are mainly through air. While most of the lead discharged into air falls out near the source, about twenty percent is widely dispersed. Lead in air may be transferred to plants directly through fallout or indirectly through up-take from the soil.

India is an agriculture based country and wheat is one of the major cereal crop grown in India. Wheat (*Triticum aestivum* L.) is a member of the Poaceae (Gramineae) family . It is an excellent source of multiple essential nutrients, such as protein, fiber, manganese, phosphorus , niacin , several B-vitamins and other dietary minerals. Thus, it is important to study the effect of toxicity of lead on this crop.heatgrass is a member of

MATERIALS AND METHODS

Wheat (*Triticum aestivum*, L. cv. HD-2285) seeds for the experiments were purchased from a local seed market. The seeds were selected on the basis of uniformity in shape, size and weight. The seeds were sterilized in 10% Sodium hypochlorite solution

for twenty minutes to prevent fungal growth, washed with distilled water for several changes. The heavy metal lead used in this study was in the form of lead nitrate. The selected concentrations of Pb were 0 (control), 10^{-5}M , 10^{-4}M , 10^{-3}M, and 10^{-2} M, respectively. Seed germination and seedling growth test was carried out in glass petri dishes with three layers of filter paper on the bottom. Each dish contained 10 ml of metal solution or 10 ml of distilled water (control), and 100 seeds, covered by lid. Petri dishes containing seeds were incubated for 9 days in a dark chamber at 25 ºC ± 1 ºC. Number of geminated seeds was counted at 3rd day after the treatments. Seedling lengths & dry weight were recorded at 5th day, 7thday and 9thday of radicle emergence. Each treatment was in triplicate.

RESULTS AND DISCUSSION

The germination percentages of wheat seeds exposed to different concentrations of lead are given in Table- 1. The seed germination rate over control decreased significantly with increasing lead concentration. Germination of seeds in control set was complete within 3 days of plating but in different concentrations germination was delayed by 1 to 3 days. Seed germination of wheat seeds was delayed by one day in 1 x 10^{-4} M Pb, by two days in 1 x 10^{-3} M Pb and by three days in 1 x 10^{-2} M Pb concentration. It was observed that at 10^{-5} M Pb there is no significant reduction in germination. Germination inhibitory rate of Pb increased by 4.3%, 15.9%, 35.8% and 92.5% at 10^{-5}M, 10^{-4}M, 10^{-3}M and 10^{-2}M, respectively. Earlier workers have also shown that heavy metals affect seed germination in plants. Jadia and Fulekar (2008) obtained similar results in a study using Cd, Cu, Ni, Pb and Zn on sunflower seeds. The effect of chromium on germination of different varieties of wheat was studied by Datta et al.(2011) who found that in all the five wheat varieties studied by them the germination is about 65- 80% at 100 ppm. Mahmood et al.,(2007) studied the effect of 1 to10 ppm copper on wheat and found that at 10 ppm copper (10µM), there is more than 35% reduction in seed germination. Peralta et.al.(2001) found that 40 ppm of Cr(VI) reduced the ability of seeds of *Medicago sativa cv.* to germinate and grow by 23% in the contaminated medium.

Table-1. Seed germination rate (%) of *Triticum aestivum* L.,cv, HD-2285 at different concentrations of lead.

S.No.	Concentrations of Pb	Germination Rate (%)	Inhibitory Rate (%)
1.	Control (0)	100.0 ± 5.6	0
2.	10^{-5}M	95.7 ± 3.5	4.3
3.	10^{-4}M	84.1 ± 2.5	15.9
4.	10^{-3}M	64.2 ± 1.4	35.8
5.	10^{-2}M	7.5 ± 1.0	92.5

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BIODIVERSITY OF *HAEMONCHUS* PARASITIZING INTESTINE OF SHEEP

D.K. Chauhan, Tikam Singh, Jyoti Saini and S.S. Lal

Immunotoxicology Laboratory, Department of Zoology,

C.C.S.University, Meerut - 250005, (U.P.), India

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ABSTRACT

Brookes et al (2002) said that 21st century is to be considered a new age of discovery espically from biodiversity (diversity) of species. Comparative base line and archives for biodiversity of species and essential for studying biotic responses of host parasites system. The impact of parasitic infections constitutes significant health and social problem (WHO, 1987). Biodiversity of species in animal parasites belonging to protozoan , Trematodes, Cestode, Nematodes, Phytonematodes and arthropods has been studied by various working in various hosts. Sheep is the most economically important mammals. Present study deals with biodiversity of *Haemonchus* intraintestinal nematode of sheep. Parasites were collected from the intestine of freshly autopcized sheep. The parasites were processed for microscopic examinations after mounting them in lactophenol, Microphotography was done.

Key words-: *Biodiversity, Haemonchus intra-intestinal nematode, Trematodes, Cestode.*

Both prokaryotic and eukaryotic parasites affect human welfare. The symptoms of disease depend on specific species. Because of antigenic variations new parasites keep on emerging. Biodiversity of parasites keep on changing due to effect their ecological niche and them variation. It need constant and continuous search of biodiversity of species. Helminthic infection are most common infection in the World. C. Pawlonski (1984). Various taxonomic character gave various taxonomic characters to identify the nematode parasites. Brooks (2002) said that a new age of discovery especially from biodiversity of species is essential. In present study biodiversity of genus *Haemonchus* have been studied.

MATERIALS AND METHODS

In present study parasitic adults were collected from the intestine of freshly autopcised sheep. Intestine was obtained from the local slaughters house. The mesenteries were removed for slaughtening coils of intestine. The intestine was cut open longitudinally with the help of blunt end of scissor. Whitish parasites were picked up genteelly by forcep. Parasites were washed in tap water, then with double distilled water and then kept in petri plates containing normal saline. Excess of saline was rinsed and then parasites were fixed in hot 70% alcohol. After cooling, the parasites both male and female were preserved in 90% alcohol. The parasites were processed for microscopic examinations after clearing and mounting them in lactophenol. Microphotography was done and

The data of seed germination rate are means ±s.e. from three experiments.

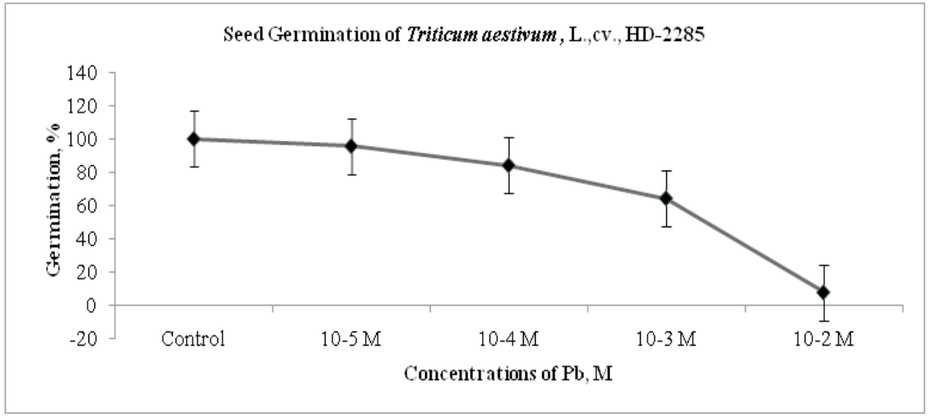

Fig-1: Effect of Pb on Seed Germination of *Triticum aestivum* L., cv., HD-2285

In the present experiment, the toxicological effects of Pb on the wheat seedlings were observed. The inhibitory effects of Pb on the lengths and dry weight of young seedlings were evaluated (Table -2, 3 & 4). The effect of different concentrations of lead on radicle length of seedlings is shown in fig. 2. There is significant reduction in radicle length over control at 10^{-4} M Pb and above concentrations while at 10^{-5} M Pb there is no significant reduction in radicle length in wheat . The effect of different concentrations of lead on plumule lengths of seedlings is shown in fig. 3. Significant reduction was observed in plumule length over control at 10^{-3} M Pb and above concentrations while at 10^{-5} M Pb & 10^{-4} M Pb there was no significant reduction in plumule length.

The effect of different concentrations of lead on dry weight of seedlings is given in table-4. It was observed that at 1x 10^{-3} M Pb concentration on 5^{th} ,7^{th} & 9^{th} day ; dry weight of radicle was inhibited by 70.39%, 75.88 % & 81.11% as compared to control, respectively while dry weight of plumule on 5^{th} ,7^{th} & 9^{th} day was inhibited by 65.80%, 74.9% & 76.71 % as compared to control, respectively. Hussain et al.,(2010) found that chromium and lead metal were more toxic to mash beans cultivars at higher levels as compared to their lower one.

Mahmood et al.,(2007) found that at 10 ppm copper (10μM), there is about 42% reduction in shoot length of wheat (*Triticum aestivum* L.) Treatment of *Leucaena leucocephala* with 25, 50, 75 and 100 ppm of lead and cadmium showed a gradual reduction in seed germination and seedling growth (Shafiq et al., 2008). Present investigations on seedling growth are also comparable with the findings of Akinci I. E., et.al (2010), Aydinalp C., et.al. (2009), Singh P., (2000, 2010, 2011, 2012, 2015), Ghani A.,(2011), Khan M. R., et.al.,(2010), Li W., et.al.,(2005) , Narian K. , et.al. , (2012) & Wierzbicka M., et. al. (1998) , .

Table 2. Effect of Pb on Radicle length of wheat .

S.No.	Concentrations of Pb (M)	5th day		7thday		9thday	
		Radicle Length(cm)	Inhibitory rate (%)	Radicle Length(cm)	Inhibitory rate (%)	Radicle Length(cm)	Inhibitory rate (%)
1	Control(0)	3.9	0.0	8.1 ± 0.5	0.0	9.9 ± 0.3	0.0
2	10^{-5}M	3.7 ± 0.2	5.12	6.7 ± 0.2	17.28	7.9 ± 0.5	20.20
3	10^{-4}M	2.4 ± 0.1	38.46	4.9 ± 0.5	39.51	5.7 ± 0.3	42.42
4	10^{-3}M	1.4 ± 0.1	64.10	2.7 ± 0.5	66.67	3.1 ± 0.5	68.69
6	10^{-2}M	n.d.	100	n.d.	100	n.d.	100

The data of Radicle length are means ± s. e. from three experiments.

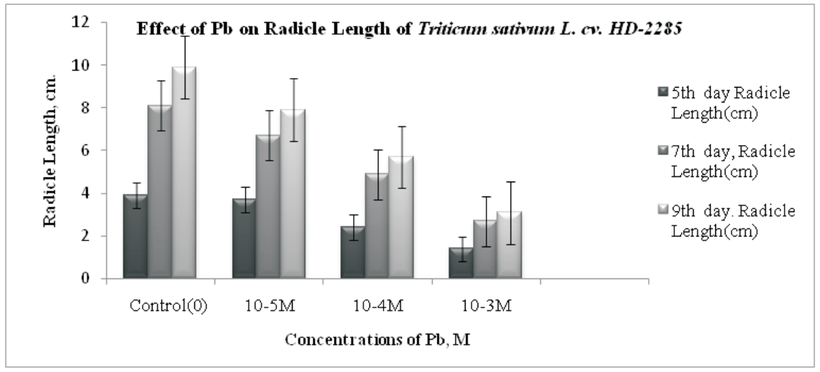

Fig-2: Effect of Pb on Radicle length of *Triticum aestivum* L.,cv, HD-2285

Table 3. Effect of Pb on Plumule length of wheat .

S.No.	Concentrations of Pb (M)	5th day		7thday		9thday	
		Plumule Length(cm)	Inhibitory rate (%)	Plumule Length(cm)	Inhibitory rate (%)	Plumule Length(cm)	Inhibitory rate (%)
1	Control(0)	3.2±0.5	0.0	6.7±1.3	0.0	10.2±1.5	0.0
2	10^{-5}M	3.0±0.4	6.25	6.0±0.7	10.44	9.4±1.3	07.84
3	10^{-4}M	2.6±0.5	18.75	5.1±0.8	23.88	8.2±1.8	19.60
4	10^{-3}M	1.8±0.1	43.75	3.6±0.7	46.26	4.0±1.0	60.78
6	10^{-2}M	n.d.	100	n.d.	100	n.d.	100

The data of Plumule length are means ± s. e. from three experiments.

27.	BM-4	37.2	S
28.	ML-1464	39.4	S
29.	EKV-AKM-4	34.6	S
30.	PM 09-11	32.8	S
31.	AKM-10-13	33.0	S
32.	KM 22-93	40.8	S
33.	IM 306-6	35.6	S
34.	WGG 979	38.2	S
35.	ML 1907	52.4	S
36.	RNG-1004	35.8	S
37.	RVSN-11-9	86.8	S
38.	IPM02-14	59.8	S
39.	AKM 8802	55.2	S
40.	Pusa 1271	52.4	S
41.	DGG-1	37.6	S
42.	IPM-02-3	33.6	S
43.	Pusa -1171	27.6	MR
44.	MH-02-15	29.2	MR
45.	DGG-054	26.0	MR
46.	TMB-36	44.0	S
47.	VGG-01-011	59.4	S
48.	IPM-2K 15-4	36.0	S
49.	Pusa 672	43.4	S
50.	ML-818	34.4	S

Results showed that out of 50 different mungbean lines/germplasm screened none was either highly resistant or resistant to root-knot nematodes. 5 lines exhibited moderately resistant reaction, while 44 found to be susceptible and 1 highly susceptible as compared to check. (Table-1) The results suggest that degree of resistance in the lines/germplasm is directly correlated with the degree of root-galling by the root-knot nematode.

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seeding, each plant in a line was removed carefully, washed free of soil and rated for root-knot intensity. Three replications of each lines was taken. The maximum root-knot index in any of the replicate of each germplasm/lines was considered for classifying the genotypes into different categories as per the scale given by (Gaur et al., 2001). The genotypes were categorized 0-10galls/root system – Resistant, 11-30 galls/root system –Moderately resistant (MR), 31-100 galls/root system – Susceptible (S), > 100 galls/root system – Highly susceptible (HS). Combining all the results, maximum rating grade in each line was considered for disease reaction. Observation was recorded 60 days after nematode inoculation on the number of galls/plant, gall index and number of eggs/eggmass and genotypes were categorized for resistance reaction.

Root-knot nematode brought about significant reduction in the plant growth of most of the lines/germplasm. There were also found reduction in the root-nodulation. The degree of reduction showed positive relation with root-knot development in all the lines/germplasm.

Table -1. Screening of mungbean lines/Germplasm against *Meloidogyne incognita* race 1.

S. No.	Germplasm/lines	No. of Galls	Reaction
1.	Pusa 9971	76.2	S
2.	MH-318	61.0	S
3.	TM-96-2	126.4	HS
4.	Pusa 672	52.2	S
5.	KM-7-134	58.8	S
6.	MH-521	66.2	S
7.	IPM-02-19	32.2	S
8.	SM-11-75	39.4	S
9.	AKM-9904	30.6	S
10.	Pusa 9072	35.0	S
11.	Pusa 871	27.4	MR
12.	SM-11-80	37.4	S
13.	Pusa 9531	47.8	S
14.	IPM-02-3	33.2	S
15.	Pusa ishal	37.8	S
16.	PS-16	27.4	MR
17.	Harch 114	40.0	S
18.	Pusa ratna	50.0	S
19.	Pusa 1031	35.6	S
20.	PDM 139	35.0	S
21.	GM-04-02	34.0	S
22.	ML-1628	52.4	S
23.	IVT Unnati	40.6	S
24.	MH-805	36.0	S
25.	ML-1661	32.8	S
26.	MDNK 10-35	48.0	S
S. No.	**Germplasm/lines**	**No. of Galls**	**Reaction**

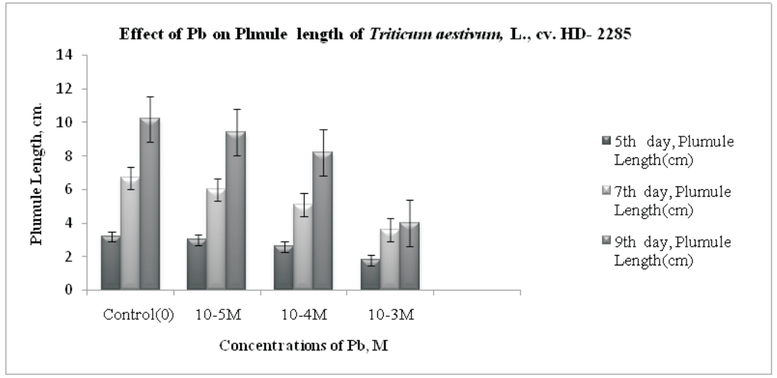

Fig-3: Effect of Pb on Plumule length of *Triticum aestivum* L.,cv, HD-2285

Table -4 : Effect of Pb on Dry Weight of Radicle & Plumule of Wheat

S.No.	Concentrations of Pb (M)	5th day		7th day		9th day	
		Radicle Dry Weight(mg)	Plumule Dry Weight(mg)	Radicle Dry Weight(mg)	Plumule Dry Weight(mg)	Radicle Dry Weight(mg)	Plumule Dry Weight(mg)
1	Control(0)	2.77± 0.2	1.93± 0.3	4.56 ±0.5	4.19±0.5	6.94 ± 0.3	5.97±0.2
2	10^{-5}M	2.53 ± 0.2	1.67± 0.2	4.10 ± 0.2	4.01±0.4	5.6± 0.5	5.16±0.5
3	10^{-4}M	1.83 ± 0.1	1.22± 0.1	3.25 ± 0.5	3.35±0.5	4.12± 0.3	3.99±0.2
4	10^{-3}M	.82 ± 0.1	.66± 0.1	1.1 ± 0.5	1.05±01	1.51± 0.5	1.39±0.1
6	10^{-2}M	n.d.	n.d	n.d.	n.d.	n.d.	n.d.

The data of Dry Weight of Radicle & Plumule of Wheat are means of ± s. e. from three experiments.

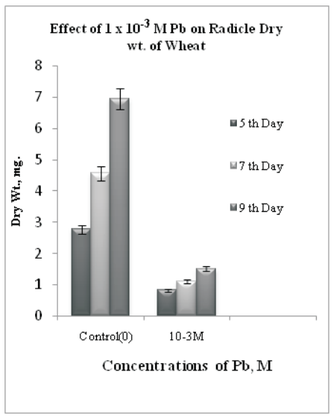

Fig-4: Effect of Pb on on Dry Weight of Radicle of *Triticum aestivum* L.,cv, HD-2285

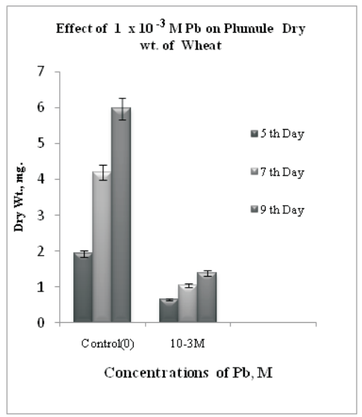

Fig-5: Effect of Pb on on Dry Weight of Plumule of *Triticum aestivum* L.,cv, HD-2285

In the present study, addition of lead (Pb) inhibited seed germination and seedling growth of wheat (*Triticum aestivum* L., cv. HD-2285), although very low concentration was apparently not harmful. The metal toxic status of plumule elongation and dry weight is similar with the result of radicle elongation and dry weight; the only difference is the lead concentrations which caused significant inhibition for plumule growth was much higher than that for radical growth. That can be explained that lead accumulation in roots of wheat seedlings was more than those of in leaves under the same metal treatment. However, further studies are needed to test, if this heavy metal enters the food chain even when the growth of wheat is not drastically effected.

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EVALUATION OF MUNGBEAN LINES/GERMPLASM FOR RESISTANCE TO ROOT-KNOT NEMATODES, *MELOIDOGYNE INCOGNITA*

Archana U. Singh and D. Prasad,
Division of Nematology, ICAR-IARI, New Delhi-12

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ABSTRACT

Pulses are very important protein source of vegetarian diet and has high vitamin content. Among nematode disease of pulse crops, root-knot disease is predominant and wide spread throughout the pulse growing regions of the country. Therefore, an attempt was made to screen 50 mungbean lines/germplasms received from IARI for their reaction in microplots infested with population of Meloidogyne incognita. It was found that out of 50 different mungbean lines/germplasm screened none was either highly resistant or resistant to root-knot nematodes. 5 lines exhibited moderately resistant reaction, while 44 found to be susceptible and 1 highly susceptible as compared to check.

Key words : *Nematode, pulses, mungbean, screening, germplasm.*

Plant-parasitic nematodes are one of the important constraints in reducing both the quality and quantity of pulse crops. They are considered to be a hidden enemy of crops due to their microscopic size, hidden habitats and lacking in manifestation of clear-cut symptoms on the aerial parts of the plants. Among nematode disease of pulse crops, root-knot disease is predominant and wide spread throughout the pulse growing regions of the country. Out of the species of root-knot nematode reported in India, only *Meloidogyne incognita* and *Meloidogyne javanica* are the causal agent of root-knot disease in pigeonpea, mungbean, chickpea, cowpea, etc. Although a number of plant-parasitic nematodes such as *Rotylenchulus* spp., *Pratylenchus* spp., *Tylenchorhynchus* spp., *Hoplolaimus* spp are also infesting pulse crops but they are considered less potential than root-knot nematodes.

Pulses are very important protein source of vegetarian diet and has high vitamin content. Pulses are equally important for maintaining soil health and sustainability of different cropping systems. They have an inherent quality to trap the moisture from lower strata of the soil, therefore they are considerably moisture stress (drought) tolerant and fit well in rainfed environment. Mungbean crop belonging to Family Fabaceae is an important protein source of vegetarian diet and affected by root-knot nematode (*Meloidogyne* spp.) causing severe damage and interferes with nitrogen fixation by rhizobium. Thus, growing of resistant varieties is an eco-friendly and economical option for nematode management which can be easily adopted by farmers. On an average, pulses contain 20-25% protein on dry seed basis, which is almost 2.5-3.0times of the value normally found in cereals which are the major source of energy. Therefore, an attempt was made to screen 50 mungbean lines/germplasms received from IARI for their reaction in microplots infested with population of *Meloidogyne incognita.*

Twenty seeds of each of the lines were seeded with inter and intra row spacings of 20 cm and 10 cm respectively. Sixty days after

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problems and increasing production efficiency specially in stressed feeder calves.

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embryonic mortality lower for hiefers fed chelated mineral supplements.

3. **Proteinates:** The product resulting from the chelation of a soluble salt with amino acid and/or partially hydrolysed protein is known as metal proteinates. Proteinates forms are commercially available for few trace elements like copper, cobalt, magenese and zinc. Kincaid et al. (1986) compared copper porteinate and copper sulphates in terms of their ability to increase copper status in young calves fed a hay concentrate diet high in molybdenum. After 84 days feeding calves given 26 mg of copper/day from copper proteinate had higher plasma and liver copper concentration than calves supplemented with similar level of copper from sulphate form.

4. **Metal amino acid complexes:** Metal complexes commercially available include zinc-methionine (Zn – Met), zinc – lysine (zn – Lys), manganese-methionine (Mn- Met), Iron – methionine (Fe-Met) and Copper – lysine (Cu – Lys)

a) **Zinc Methionine:** Zinc-methionine has been studied to the greatest extent of any of the chelated or metal complexes currently available. Bioavailability of Zn from Zn-Met and reagent grade zinc oxide was similar in lambs fed a semi purified died deficient in zinc, but zinc from these two sources appeared to be metabolized differently following absorption, as the urinary excretion of zinc tended to be lower in lambs fed Zn-Met resulting in higher zinc retention (Spears, 1989). The zinc methionine complex is not degraded to a large extent by rumen micro organisms. Wang et al. (1998) studied the effect of different zinc sources on the sites of zinc digestion and absorption in the digestive tract of sheep. Apparent zinc absorption in the duodenum of sheep fed on Zn-Met was significantly higher than those fed on zinc oxide and basal diet. The improved level of methionine in the duodenum indicated that Zn-Met chelates are able to bypass the rumen in the sheep.

b) **Maganese methionine:** Relative availability of maganese from Mn-Met was 120 percent of that present in maganese sulphate based on maganese accumulation in the bone, kidney and liver of lambs fed high dietary maganese (Henry et al. 1992). Ruminal concentration of soluble maganese were higher in steers fed Mn-Met compared to steers supplemented with maganese in suphate or oxide form (Ward et al. 1992).

c) **Copper lysine:** The association of copper with protein or amino acid in the form of chelates or complexes has been reported to increase the availability of copper (Kratzer and Vohra, 1986). Ward et al. (1993) compared copper lysine and copper sulphate in growing steers fed high molybdenum diets and found that bioavailability of copper form the two sources was similar based on plasma copper concentration and activity of ceruloplasmin, a copper dependent enzyme. Greene et al. (1995) concluded that copper lysine was beneficial in decreasing health

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EFFECT OF GA_3 AND NAA ON GROWTH AND YIELD OF BRINJAL (*SOLENUM MELONGENA* LIN.) CV. PUSA PURPLE LONG

[1]Hemlata Pant, and [2] A.K. Raza

1. Society of Biological Sciences and Rural Development Jhunsi Allahabad - 211019, (U.P.), India
2. N.G.B.U., Allahabad, (U.P.), India

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ABSTRACT

An experiment on the effect of GA3 and NAA was conducted on brinjal cv.Pusa Prple Long during the kharif season of 2013-14. The different concentration of GA3 (30, 50, 70 and 90 ppm) and NAA (30, 60, 90 and 120 ppm) were sprayed on the crop to study the growth behavior and yield and yield attributes of brinjal. It was found that there was a linear increase in growth parameters like plant height and number of branches per plant with increasing level of GA3 and NAA. The maximum plant height was recorded as 85.3 cm and 82.3 cm with the application of GA_3 @ 80ppm and NAA @ 100ppm, respectively after 60 days of transplanting. Similarly, the yield and yield attributes were also affected significantly with increasing concentrations of GA_3 and NAA. A maximum yield of 483.6q/ha and 472.2 q/ha was obtained with the use of GA3 @ 80ppm and NAA@100ppm, respectively.

Keywords: Brinjal, GA^3, NAA, growth character, yield and yield attributes.

Vegetable is the most important component of a balanced human diet and act as a protective food. Among vegetables, brinjal (*Solanum melongena* Lin.) is one of the most popular and widely grown vegetables in the world, and it is grown under wide range of climatic conditions. Presently, a large number of growth regulators are available in the market but they are of two types i.e. growth promoters and growth inhibitors or retardants. Among growth promoters, Gibberellic Acid (GA3) and Naphthalene Acetic Acid (NAA) play an important role to in improving the plant growth and yield of vegetable crops. GA3 is one of the important growth stimulating substances which promote cell elongation and cell division thus help in the growth and development of many plants.It breaks genetic dwarfism of the plant. NAA affects the physiological processes, hastens maturity and improving the quality of fruits. It alos increase number of flower per plant and fruit setting in particular.There are many cultural and chemical practices to increase the yield of the crops. Application of plant growth regulator for improving the yield and quality of many vegetable crops has been emphasized by several workers (Pundir and Yadav, 2001, Bhosle *et al.,* 2002 and Meena, 2008). However, the improvement in the yield and quality of the crops mainly depends on the concentration of plant growth regulator and time of application (Singh, 1995). Therefore, the present investigation was carried out to study the effect of Naphthalene Acetic acid (NAA) and Gibberellic Acid (GA3) on growth and yield of brinjal cv. Pusa Purple Long.

MATERIALS AND METHODS

The present experiment was conducted at the Department of Horticulture Kulbhasker Ashram Post Graduate College ,Allahabad during 2013-14. The soil of the experimental site was sandy loam texture and slightly alkaline reaction (pH 7.85). It was non-saline in salt content (EC 0.563 dS/m) low in organic carbon (0.50 %) and available nitrogen (285.0 kg/ha), medium in K (264 kg/ha) and high in available P (37.6 kg/ha). The experiment was laid out in Randomized Block Design (RBD) with three replications .The treatments comprised of four levels each of Gibberellic Acid (GA3) i.e. (30, 50, 70 & 90 ppm) and NAA (30, 60, 90 &120ppm) along with a control. Thirty days old seedlings of Brinjal were transplanted at a distance of 80 cm X 50 cm in rows . Nitrogen was applied @100kg/ha in three split doses. Half dose of nitrogen was applied as basal and rests half in the two equal split doses at 30 and 60 days after transplanting. Potassium and phosphorus were applied @ 50kg /ha each as basal through muriate of potash and single super phosphate, respectively. For the application of growth regulators solutions were prepared in distilled water. The spraying of these solutions of GA3 and NAA was done as per the treatments at different time intervals. The first spray was done after 20 days of transplanting and subsequently three sprays were done at 14 days intervals. The crop was raised following standard agronomic practices. The data on growth parameter like plant height, number of branches were recorded at different growth stages by selecting five plants randomly in each experimental plot. Similarly, the yield and yield attributing parameters were also recorded and the data were analyzed as per standard analytical procedures.

RESULTS AND DISCUSSION

The data on growth parameters i.e. plant height and number of branches as influenced by GA3 and NAA application at various growth stages are presented in Table no.1. It is evident from the data that the plant height and number of branches/plant increased significantly with the increasing level of GA*3* and NAA. The maximum plant height was recorded as 106.6cm with the spray of GA3 @ 90 ppm and at 70 days after transplanting (DAT). Similar trend was also noticed with the number of branches per plant. This might be due to rapid increase in cell division and cell elongation in the meristematic region. These results are in conformity with those of Gupta and Gupta (2000) and Rai *et al.*, (2006). The presented in table 2 clearly show that fruiting and yield parameters such as percent fruit set, number of fruits/plant, average fruit weight, length of fruit, fruit width and fruit yield/ha increased significantly with the application of GA3 and NAA. It is due to the fact that application of GA3 and NAA check the flowers and fruit drop and ultimately increase the percent of fruit set. These findings are in accordance with the work reported by Meena, (2008). Application of GA3 and NAA significantly increased the number of fruits per plant. The increasing number of fruits per plant by GA3 and NAA treatment might be due to rapid and better nutrient translocation from roots to apical parts of the plant. These results are in accordance with those reported by Singh *et al.,* (2001) and Bhosle *et al.,* (2002). The size and weight of fruit is also an important aspect as these characters are useful for yield determination and consumer's acceptability. The average fruit weight, length of fruit and width of fruit were significantly increased with the application of GA3 and NAA and the

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EFFECT OF ORGANIC TRACE MINERALS IN LEVESTOCK PRODUCTION

Sheetla Prasad Verma
Department of Animal Science,
K.A.P.G. College Allahabad-211001 (U.P.), India

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ABSTRACT

The development and marketing of organic minerals or chelated minerals has centred around the theory, that they are more bioavailable, or more similar to forms that occure in the body than inorganic sources. If the chelated mineral is stable in the digestive tract, the mineral would be protected from forming complexes with other dietary components that inhibit absorption, leading to more absorption. Organic trace minerals supplement may be metal complexes or chelates or proteinates, which have been discussed in the light of their bioavailability and effect on livestock production.

Keywords: *Organic trace minerals, chelated minerals, proteinates , absorption, livestock production.*

Trace minerals have traditionally been supplemented to livestock's diets as inorganic salts. In recent years, there has been considerable interest in the use of metal complexes, chelates or proteinates (organic trace minerals) in runinants diets. Certain organic trace minerals may stimulate certain biological processess or the mineral present in the organic form may enter different pools with in the body than inorganic forms as reported by Neathery et al. (1972) for zinc in calves. Interest in the feeding of metal amino acid complexes, zinc, methionine, maganese methionine, proteinates, metal amino acid chelates and metal polysaccharides complex has been stimulated by reports of improved growth, reproduction uand health in livestock feed organic trace mineral

RESULTS AND DISCUSSION

1. **Metal Polysaccharides complex:** Metal polysaccharide complexes are formed by complexing of a soluble salt with a polysaccharide solution. Dicostanjo et al. (1986) reported that the addition of maganese polysaccharide complex to a control corn silage based diet decreased the number of services for conception and days to conception in beef cows. Much work has not been done on supplementation of metal polysaccharide complex.
2. **Metal Amino acid chelates :** Amino acid chelates are available for zinc, copper, maganese and cobalt in addition to calcium and magnesium. Manspeaker et al. (1987) fed Holstein heifers a control diet or the control diet plus an amino acid chelated mineral supplement. The amino acid chelated supplement supplied additional iron, maganese, copper and zinc in addition to potassium and magnesium. Ovarian activity tended to be higher and

production and oil yield. The aromatic oil extracted with distillation of foliage in Clevenger's apparatus on the basis of hydro-distillation at 60oc.The extracted essential oil stored in glass containers or jars and protected from sunlight.

RESULTS AND DISCUSSION

Lemon grass, an aromatic oil containing and potash responsive herb which positively correlated with basal application of potassium as potassium chloride (Murate of potash) before slip transplantation in field soil of experimental plots. The data of Table 1 reveal that successive increase in potassium level significantly increased plant growth such as plant height and number of tillers per hill as well as herbage production and oil yield of lemon grass. The highest response was recorded with basal application of 60 Kg ha- potassium in comparison to lower doses over control. Kumar (2002) and Singh et al. (2003) also reported that application of potassium@50Kg as basal dose and 50 Kg as spray enhanced herbage production and oil yield of lemon grass due to increasing doses of potassium ratio in plant tissues. These results also indicated that application of such high dose(s) of potassium in perennial irrigated lemon grass is beneficial to better plant growth as well as herbage production and oil yield.

Table 1: Effect of potassium application as basal dose on plant growth, herbage production and oil yield of lemon grass

Characters	**Plant growth Parameters**								**Yield attributes**			
Treatments	**Plant height**				**Tillers per hill**				**Herbage Production(Kg)**		**Oil Production**	
Potash level@ Kg/ha	60 DAT	90 DAT	120 DAT	Mean	60 DAT	90 DAT	120 DAT	Mean	Per Plot(6.0 sq. m size)	Per ha	Oil content(%)	Oil yield(Kg/ha)
T1: 00 Kg /ha	79.85	98.30	124.20	100.78	25.20	37.20	54.00	38.80	12.10	161.45	0.44	71.80
T2: 20 Kg /ha	81.50	103.20	128.30	104.33	36.00	47.60	60.00	47.87	14.05	186.67	0.47	88.90
T3:40 Kg/ha	82.93	105.80	149.20	112.64	42.40	52.00	70.50	54.96	17.81	236.53	0.50	118.27
T4:60 Kg/ha	91.00	115.70	175.90	127.53	48.00	59.90	87.10	65.00	23.49	312.18	0.52	162.2
Mean	83.82	105.75	144.40	111.32	37.90	49.17	67.90	51.56	16.86	224.21	0.48	110.29
CD (P=0.05)	**2.98**	**9.78**	**3.13**	**-**	**5.13**	**10.68**	**5.67**	**-**	**5.54**	**-**	**0.03**	**2.37**

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maximum values were recorded at 90 ppm of GA3 and 70 ppm of GA3. This may be attributed to the increased supply of photosynthetic materials and its efficient mobilization in plants giving rise to increased stimulation of fruit growth ultimately resulting in increased fruit weight, fruit length and fruit width Bhosl*et. al*., (2002) and Pundir and Yadav (2001). The fruit yield per hectare significantly increased with the application of NAA and GA3 as compared to control. The maximum fruit yield (583.6q/ha) was obtained with application GA3 @90 ppm closely followed by GA3 @ 70 ppm (546.50q/ha). The possible reason for increasing in fruit yield per hectare is due to increase in number of fruits per plant, average fruit weight and fruit yield per plant. These results are in conformity with the finding of Akhtar *et al*., (1996) and Soha *et al*., (2009). From these results, it may be inferred that the application of GA3 @90 ppm may be adopted to enhance the productivity of brinjal.

Table 1. Effect of GA3 and NAA on growth attributing characters of brinjal.

Treatment	**Plant Height (cm)**	**Primary Branches/plant (no.)**	**Secondary Branches/plant (no.)**	**Plant canopy area (cm2)**	**Stem girth at collar region (cm)**	**Leaves/plant (no.)**	**Leaf area/plant (cm^2)**
Control	45.60	18.2 0	28.5 0	224.3 0	15.4 0	440 .00	1380.70
GA 30 ppm	70.4 0	28.50	45.10	400.80	21.92	529.45	1496.20
GA 50ppm	85.2 0	32.50	55.20	625.06	26.21	625.48	1618.60
GA 70 ppm	92.3 0	36.20	60.70	900.92	30.20	720.52	1746.50
GA 90ppm	106.6	40.20	65.80	1200.46	37.86	918.56	1983.60
NAA30ppm	60.10	27.50	44.10	304.60	18.72	505.44	1440.50
NAA60ppm	65.70	31.70	40.20	514.82	20.90	510.45	1502.70
NAA90ppm	79.50	33.40	50.80	715.78	25.11	632.50	1533.60
NAA120ppm	74.10	34.70	60.60	816.08	30.38	630.55	1524.20
CD(0.05)	3.42	9.50	6.48	21.23	1.21	11.03	35.60

Table 2. Effect of GA_3 and NAA on yield and yield attributing characters of brinjal.

Treatment	**Percent fruit set**	**No. of fruits/ plant**	**Fruit weight (g)**	**Fruit length (cm)**	**Fruit width (cm)**	**Seeds per fruit (no.)**	**Fruit yield (q/ha)**
Control	35.6	23.2 0	90.5 0	14.3 0	5.4 0	40.40	380.70
GA 30 ppm	40.4	28.50	95.10	14.80	5.92	29.45	496.20
GA 50ppm	45.2	32.50	130.20	1.06	6.21	25.48	518.60
GA 70 ppm	52.3	36.20	135.70	15.92	7.20	20.52	546.50
GA 90ppm	56.6	40.20	140.80	16.46	7.86	18.56	583.60
NAA30ppm	37.1	28.50	94.10	14.60	5.72	35.44	490.50
NAA60ppm	42.7	31.70	128.20	14.82	5.90	33.45	502.70
NAA90ppm	49.5	33.40	131.80	15.78	7.11	32.50	533.60
NAA120ppm	54.1	34.70	138.60	16.08	7.38	30.55	574.20
CD(0.05)	3.42	9.50	6.48	1.23	1.01	1.03	15.60

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EFFECT OF POTASSIUM NUTRITION ON PLANT GROWTH, HERBAGE PRODUCTION AND OIL YIELD OF LEON GRASS (*CYMBOPOGON FLEXUOUS*)

Shiv Pujan Singh, R.P. Singh, Pradeep Kumar* and Rajneesh Pathak**
Department of Agricultural Chemistry and Soil Science, Udai Pratap P.G. College, Varanasi, (U.P.), India
*Plant Protection (Plant Pathology), KVK, Ambedkar Nagar - 224168 (U.P.), India
** ATMA, Department of Agricultural, Sultanpur, (U.P.), India

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ABSTRACT

A field trial was conducted to test the effect of potassium nutrition on plant growth, herbage production and oil yield of lemon grass during Kharif, 2005 at Central Research Laboratory Farm, Department of Agricultural Chemistry and Soil science, Udai Pratap PG College, Varanasi (U.P.).The results reveal that successive increase in potassium level significantly improved plant height, number of tillers per hill, herbage production and oil yield of Lemon grass. The highest response was recorded with basal application of 60 Kg potassium per hectare in comparison to 20 Kg potassium and 40 Kg Potassium per hectare over control.

Keywords **:** *Lemongrass, effect, potessium nutrition.*

Lemon grass (*Cymbopogon flexuous*) is a useful aromatic herb which provides essential oil for cosmetic industries as well as green leaves for essence or fragrance in hot drinks in modern era. Potassium nutrition in plants increases systemic acquired resistance (SAR) against diseases, drought and frost as well as it provide a vital role in translocation of metabolites from foliage to oil yield with balanced nutrition. The standardization of potassium level in soil and plant, three levels ie.20 Kg, 40 Kg and 60 kg per hectare were tested as basal application with 100 Kg nitrogen per hectare and 50 Kg phosphorus per hectare as full index for optimum production of herbage and oil yield in Lemon grass at farmer's fields. However, in general, 40 Kg nitrogen, 50 Kg phosphorus and 40 Kg potash per hectare applied as basal dose with rest 60 Kg nitrogen per hectare in three split doses as top dressing during crop growth period. Due to easily dissolve of potassium in water, it split into cations and appropriate anions which absorbs through roots of the growing plant.

MATERIALS AND METHODS

Field experiments were conducted during Kharif, 2005 at Central Research Laboratory Farm, Department of Agricultural Chemistry and Soil Science, Udai Pratap College, Varanasi (UP) with four levels of potassium ie. 0, 20, 40 and 60 Kg ha- and three replications in Randomized Block Design (RBD).The treatment doses applied in field soil as basal application prior to slip transplantation of lemon grass at 60x45 cm distance with the objective of better plant growth, herbage production and oil yield. Plant growth characters such as plant height and number of tillers per hill were recorded at 60, 90 and 120 days after transplantation (DAT) of root slips. Final harvest was done close to 10 cm above ground level for recording of herbage