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BIODIVERSITY AND CONSERVATION ASPECTS OF ENDEMIC FRESHWATER FISH FAUNA OF MAHARASHTRA STATE THE LIST OF FISH SPECIES GIVEN ARE NOT ONLY ENDEMIC TO MAHARASHTRA

***Swapnil S. Ghatge, *Sachin W. Belsare and **A.S. Ninawe**

*College of Fishery Science, Nagpur, Maharashtra, India

**Department of Biotechnology, New Delhi, India

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ABSTRACT

The generated information on endemic freshwater fish biodiversity of Maharashtra will help the student, researchers, planners and policy makers to frame conservation and management strategies. The present work will form a basis for further studies. Probable additions and / or deletions in the number of species are possible after detailed field surveys and after resolving taxonomic ambiguities. The district wise endemic fish should be declared in order to create awareness and conserve the endemic diversity. Further stream wise detailed surveys are necessary for documenting the diversity and understanding of resource for proper planning, sustainable utilisation and conservation.

Keywords : Biodiversity, conservation, fish.

INTRODUCTION

The freshwater ecosystems are amongst the most vulnerable natural systems on the earth spread over 0.8% of Earth's surface, cover 0.01% of world's water resource. In recent times anthropogenic activities and climatological changes are driving its biodiversity under severe crises and thus making it the most endangered natural system in the world (Suski and Cooke, 2007;Sarkar*et*Spelling? *al*., 2008;Woodward, 2010; Collen*et*spelling *al.,* 2014). In view of this, freshwater systems and its biodiversity have to be conserved and managed properly, as it incorporates an invaluable resource, in economic, cultural, aesthetic, scientific and educational terms, necessary for human health and well being (Dudgeon *et al.,* 2005). Fish is considered as one of the most valuable wild foodand Spelling?provides nutritional security and income to rural households through fisheries.

In the Asian region the knowledge of the fish faunal biodiversity and its conservation aspects are relatively less documented (Nguyen and De Silva, 2006) as it is still in exploration and discovery phase (Lundberg *et al*., 2000; Pinna, 2006). Similarly Indian fish fauna remains in need of in-depth systematic study (Lundberg *et al*., 2000) as many species are still to be described or to be discovered (Le´veˆque*et*

*al*spelling., 2008;Goyal and Arora 2009), and the available information is from a few well-studied locations only (Molur and Walker, 1998; Bhat, 2003).

India stands ninth among the mega biodiversity countries rich in freshwater ecosystems (Kar*et*spelling *al.,* 2006) and estimated to harbour 3086 fishes of which 731 are freshwater fishes (Mishra *et al.* 2013).Among the East, and South andSouth-East Asian countries, India possesses maximum number of endemic freshwater fishes (De Silva *et al*., 2007); comprising 397 species (Mishra *et al.* 2013).The freshwater resources are currently experiencing an alarming rate of decline in fish diversity (Sarkar*et* spelling*al.* 2008), with 17 species Critically endangered, 69 species under endangered and 81 species under vulnerable status in the Eastern Himalayas and Western Ghats itself (Allen *et al*., 2010; Molur*et al*spelling., 2011). Further the endemic freshwater fishes in the Western Ghats region assessed by Molur*et*spelling *al.,* (2011) are far more threatened than the non-endemics.

A living organism restricted to a particular geographic area is recognized as endemic species, which need attention owing to limited distribution along with consequent susceptibility to endangerment, if their habitats are altered it will lead to their decline and disappearance (Young, 2007). The proper understanding of endemism facilitates precise prediction of future of biodiversity (Pimm*et* Spelling?*al*., 1995) and aids in recommending conservation priorities (Myers *et al*. 2000). This calls attention for detailed evaluation of endemic fish fauna, which will bemore spellingrelevant and crucial for developing suitable conservation strategies and management policies to ensure preservation of biodiversity (De Silva *et al*., 2007).

As the endemispellingc fish diversity with restricted distribution need particular attention due to consequent susceptibility to endangerment, if their habitats are altered it will lead to their decline and disappearance. In the view of present background an endeavour is made to update the information on endemic fish species found in Maharashtra state, based on recentliterature. To fill the information gap on endemic freshwater fish species by providing relevant data at one place suitable for use within development and conservation planning processes.

ENDEMIC FISHES OF INDIA

As already mentioned among the East, and South and South-East Asian countries, India possesses maximum number of endemic freshwater fishes (De Silva *et al*., 2007); comprising 397 species (Mishra *et al.* 2013). With high level of endemism in North East India and western Ghats, comprising 152 and 149 species respectively (Mishra *et al.* 2013).Molur*et al.* (2011), reported 189 endemic freshwater fish species from Western Ghats assessment region (including Western Ghats and associated river basins; Narmada, Tapi, Godavari, Krishna, Cauvery and all other river systems in southern India), justifying the incomplete survey work in the country as mentioned above and demands a more efficient detailed state or water-shed wise study of Indian freshwater fish fauna.

MATERIALS AND METHODS

The fish species endemic to India, having distributional range in the state of Maharashtra are considered endemic species for this study. The scientific literature describing the endemic freshwater fishes of the India and Maharashtra state was reviewed (referGhatge*et*spelling *al.*, 2013) and the

followingDahanukar*et*spelling *al.* 2004, Karmarkar*et al.*, 2012, Mishra *et al.*, 2013 and Ghatge*et*spelling *al.*, 2013 as base papers and recent publication by Dahanukar*et al.* 2011, Katwate*et*spelling *al.* 2012a, Katwate*et*spelling *al.* 2015, Katwate*et*spelling *al.* 2013a, Katwate*et* spelling*al.* 2013b, Katwate*et* spelling*al.* 2014a, Katwate*et* spelling*al.* 2014b Katwate*et al.* 2015, etc. were refereed to come up with a updated list of endemic fish species of Maharashtra State.

STUDY AREA

The present study focuses on the state of Maharashtra ($15^0$35'-$22^0$02'N and $72^0$36'-$80^0$54'E) located in the North Western part of peninsular India. The state encompass three distinct physiographical regions, viz., (1) approximately 80 km wide strip of land between the Western Ghats and coastal line (Konkan), (2) 720 km of Western Ghats hill region, running parallel to the coastline and (3) the eastern plateau drained by the rivers and dotted with thousands of small reservoirs. Maharashtra (with 9.36% of the total geographic area of the country) is the third largest State in terms of area (307,713Km^2), blessed with vast freshwater resources; comprising 3.39 lakh ha of inland water bodies (SoER, 2007) and 380 rivers draining 19,269 km. Stretch (GoM, 2005).

FISH DIVERSITY OF MAHARASHTRA

Maharashtra state has been blessed with rich ichtyofaunal spelling diversity by virtue of congregation of different types of topographical, agroclimatic and hydrodynamical spelling conditions within the state boundaries, the first effort was made by Kulkarni and Ranade,1975 to document the fish diversity of Maharashtra state as a whole listing 167 freshwater fish species. **Karmarkar *et* spelling *al.*, 2012** have enumerated the freshwater fish fauna of Maharashtra comprising 216 species belonging to 11 orders, 32 families, 93 genera. But a thorough estimate of Maharashtra itself is **yet to be worked out** and this information deficiency on the diversity and distribution of freshwater fishes, (Acharya&Iftekharspelling, 2000; Molur*et al.* 2011; Jadhav*et* spelling*al.* 2011) obscure the understanding of the true patterns in fish diversity (Moluret spellingal. 2011) and becomes a hurdle in designing and implementing conservation strategies (Jadhav et alitalics., 2011).

The review of literature suggests that the Northern parts of western Ghats situated at the western border of Maharashtra and tributaries of the west flowing rivers Godavari and Krishna these rivers are not west flowing but east flowinghave not been surveyed extensively or in some cases have not been explored at all and checklists for individual rivers are not available(Jadhav *et al.,* 2011; Molur*et* spelling*al.* 2011).

ANTHROPOGENIC DEVELOPMENT AND AQUATIC HABITAT LOSS

Maharashtra, the second largest state in terms of population size (115.2 million), the third most urbanised state with an urban population of 45.23% (GOI Census, 2011), is one of the most industrialised state in the country (SOER? explain, 2007), where anthropogenic activities (predominantly, industrialisation and urbanisation) have been major factor to affect the water quality of major rivers in the state (Environment monitor, 2006). Of the 30 river basins in world prioritised for the protection of aquatic biodiversity by Groombridge and Jenkins (1998), Rivers Godavari and Krishna originate in Maharashtra and Rivers Narmada & Tapti flow from the northern border of the state. Maharashtra also

has the leading number of polluted river water stretches in the country (MPCB, 2009), highest number of large dam (1693) constructed during last century (NRLD, 2009) andlow spellingforest cover compared tothatspelling at national level (SOER, 2007). These factors with added decline in Western Ghats forest area (Panigrahy*et.* spelling*al.,* 2010) have become responsible for natural freshwater habitat loss in the state.

EXOTIC SPECIES IN MAHARASHTRA

Reservoirfisheries in Maharashtra use mostly transplanted Indian major carps (*Catlacatla, Labeorohita* and *Cirrhinusmrigala* spelling) (Sugunan 1995) and exotic species (*Hypopthalmichtysmolitrix,Ctenopharyngodo nidella* spellingand *Cyprinuscarpio*)spelling (Acharya&Iftekhar, 2000) as stocking material. Some of the reported exotic species in Maharashtra are *Oreochromismossambica* spelling (Kharat*et al.,*2003), *Clariasgariepinus* spelling (Sugunan, 2002; Singh &Lakra 2008), *Pangasianodonhypophthalamus* spelling (Krishna *et al,* 2011), *Pygocentrusnattereri*s pelling(Singh &Lakra2011), *Piaractus brachypomus* spelling*(Katwate, 2012b) Xiphophorushelleri (*spelling*Kharatet al. 2003)* and *Gambusiaaffinis, Hypophthalmichthysnobilis, Pangasianodonhypophthalmus, Oreochromisniloticus* spelling (pers. obs.). These exotic fishes are affecting the native and endemic freshwater fishes in Maharashtra (Kharat *et* spelling *al.,* 2003; Dahanukar *et* spelling *al.,* 2011).

RESULTS AND DISCUSSION

The endemic freshwater fish fauna in the state of Maharashtra is reputed to consist wrong impressionof 80 fish species belonging to five orders, 13 families and 43 genera. The family Cyprinidae has the highest number of endemic species (44) followed by Balitoridae (7), Bagridae (8), Sisoridae (5), Schilbeidae (5), Parapsilorhynchidae (4), seven other families with one endemic species each. The list of endemic fish species of Maharashtra state is given in Table 1.

The endemic fish enlisted are being traditionally a part of fisheries and source of livelihood and nutrition to the rural population (Figure 3). The lack of documentation in the inland fisheries hinders the justification of the importance of these species in rural livelihood and economy. Thilsted, 2012 enumerates the importance of nutrient-rich small fish in aquaculture in which provide essential nutrients, in particular vitamin A, calcium, iron and zinc to vulnerable population groups. Similarly most of the endemic species in Maharashtra are being providing livelihood and nutritional security to the rural poor and should be conserved. poor english

The present findings are based on the available published literature suggesting that there are 80 endemic freshwater fish in the state of Maharashtra. It is interesting to note that Indian freshwater fishes have nine endemic genera off which three genera are present in Maharashtra viz: *Parapsilorhynchus, Oryzias and Hypselobarbus. Further the genus Parapsilorhynchus with its four species is purely endemic to Maharashtra state.* Urgent need is felt to take up proper steps for conservation of these species. Review of literature reveals that the five interacting freshwater biodiversity threat categories, viz: invasion by exotic species (Figure 1);overexploitation (Figure 2); water pollution; flow modification; destruction or degradation of habitat; and (Dudgeon *et. al*., 2005), with more or less varying severity are observed in the freshwaters systems of the Maharashtra state

(Molur*et*spelling *al.* 2011). Proper conservation and management strategies are necessary restore the natural resources for safeguarding the endemic fish fauna in Maharashtra state. what are these strategies mention some of themIn addition to these direct threats, climate change represents a growing challenge to the integrity and function of freshwater systems (Dudgeon *et al.,* 2006).

Hence Conserving genetic diversity is need of the hour and the fish genetic resources can be conserved by protecting habitatsrepeating expression. Conservation should aim at endemic species and endangered species mostly through in *situ* methods and *ex situ* methods for threatened species. Existence of endemic fish biodiversity along with other biotic resources can be viewed as an indicator of wellingspelling being of fish diversity.

The harm caused to fish and habitats needs to be compensated through afforestation, eco-restoration, soil conservation, complete ban on deforestation particularly in the fragile western ghats and strict implementation of Indian Fisheries Act 1897 (modified in 1956). The water bodies in forest areas should not be stocked with transplanted species and exotic species in order to conserve the endemic fish fauna.

Figure 1. Exotic invasive species Tilapia *(Oreochromismossambicus)* fished from Kanhanriver

Figure 2. Overexploitation of young ones of Mahseer

Figure 3. Contribution of endemics and small fishes in nutritional security and livelihood

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Too many references in four pages needs to be curtailed only those which are relevant and lots of mistake needs to be looked into carefully. I have checked only one or two reference as an example all the reference have to be written in same style

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EFFECT OF CADMIUM ACETATE ON THE THYMUS OF THE WHITE LEG HORN CHICKS

D.K. Chauhan

Immunotoxicology laboratory,

Department of Zoology, C.C.S. University, Meerut (U.P.), India

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ABSTRACT

Cadmium compounds are fedral hazardous air pollution. Cadmium is a components of diesel fuel, gaoline, lubrication oil and their combustion release the cadmium into the environment. During present investigation, sublethal dose (3 mg/kg b.w.) of cadmium acetate has been administered orally in the W.L.H. chicks. Chicks were sacrificed according to experimental design at 15th, 30th, 45th day of the experiment. Significant changes have been observed in immune system of the experimental host.

Kewyords : Chicks, cadmium, thymus

INTRODUCTION

It is well known that the lymphoid organs plays an important role in the defense against environmental stresses i.e. heavy metal pollution. The Chicken has central and peripheral lymphoid tissues (Getty, 1975). The lymphoid system of chicken consist of unique organs and divided into two morphological and functionally distinct components (Cooper et al, 1965, 1966). The Thymus dependent components is represented by the smaller lymphocytes is responsible for cell mediated immunity including immunosurveillance (Janeyway et al, 1988) whereas the bursa dependent components is represented by the larger lymphocytes when transferred into plasma cell in the tissue and play an important in humoral immunity concerning this immunological point of view, the immunopathology of thymus in white leg horn chick is very important. Although differentiation immunopathological observation in native chicken (Khalil Mohsin et al, 2002, 2003 & Rahman et al, 2005) have been studied, however regarding leg horn chicks. It is yet not be done therefore the present research has been carried out to thymus of white leg horn chicks exposed to sub-lethal dose of Cadmium Acetate.

MATERIALS AND METHODS

The study was carried out on 24, newly hatched white leg horn chicks to study of immunophysiology in the Department of Zoology, CCS University Meerut. Chicks were divided into two groups —

(i) Control

(ii) Cadmium exposed group

The chicks had no developmental disorder and detachable disease that my case that may cause any problem in the abnormalities of the pathological architecture of thymus.

Thymus were collected from the control and treats chicks after 15, 30 and 45 days of post treatment. The tissue were fixed from the 10% formalin for 24 hours and were dehydrated in

the serves of the ascending grade of alcohol followed by cleaing in the three changes in xylene and make both in the paraffin wax. Finally the section were cuth 6 thickness using microwave. The histological structure of the thymus were observed using light microscope under (X10) and (X40) magnification. Photograph from the selected specimen were prepared for better illustration of the result.

RESULTS AND DISCUSSION

Structure Of Thymus Of Control White Leg Horn Chicks —

Thymus gland has been considered as primary lymphoid organ. The gland was encapsulated in a thin connective tissue. The mass of gland divided in to lobues by septa. Each lobe was divided into two region: 1. Cortex and 2. Medulla.

Cortex : The outer most region of each thymic lobule constituted the cortex and was continuation with capsule. The dense population of small lymphocytes predominated the other type of cells including reticular cell in the cortex.

Medulla : The central region of thymic lobe comprised the medulla. It showed small population of lymphocytes. Thymic corpuscles were infrequently observed along with degenerating reticular cells. (Fig. 1, 2, 3)

IMMUNOPATHOLOGICAL CHANGE IN T.S. OF THYMUS AFTER 15 DAYS OF POST EXPOSURE : —

Capsular wall was observed to be irregular. Cortex has less number of lymphocytes and showed thyme atrophy, at gap certain places, there was found to be inflammatory edema due to infiltration of lymphocytes. Medulla was observed to be more or less normal. Capsular wall also was observed to be irregular. Mild depletion of lymphocytes was observed in cortex region. Inflammatory edema was due to infiltration or red blood cells. The medullary region revealed marked array of pathology. Degeneration of reticular cells was found to be prominent. (Fig, 4, 5)

IMMUNOPATHOLOGICAL CHANGE IN T.S. OF THYMUS AFTER 30 DAYS OF POST EXPOSURE

Capsular wall found to be normal; septum which divides thymus in lobes was thickened. The cortex and medulla region were found to be almost normal with normal distribution of small and medium sized lymphocytes. The capsular and cortex region were found to be almost normal. In medulla region, some vacuole type structure, were observed which contained degenerating lymphocytes.

IMMUNOPATHOLOGICAL CHANGE IN T.S. OF THYMUS AFTER 45 DAYS OF POST EXPOSURE

No significant changes were observed in capsule, medulla but in cortex region prominent noninllammatory edema was observed.

The capsule showed normal structure, the cortex region to be normal distribution of lymphocytes. it was also revealed an increase number of reticular cells and very mild non-inflammatroy edema. (Fig. 8, 9).

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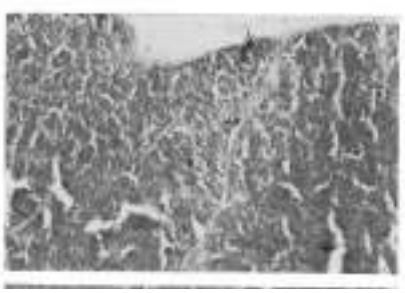

Fig-1

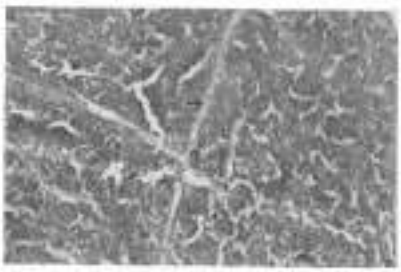

Fig-2

Fig-3

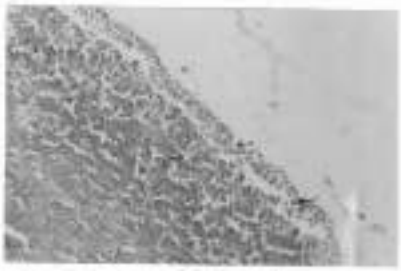

Fig-4

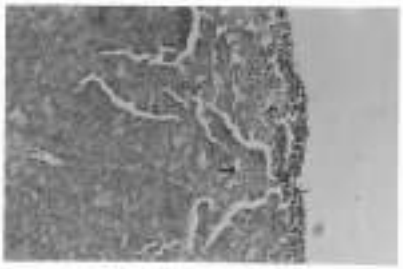

Fig-5

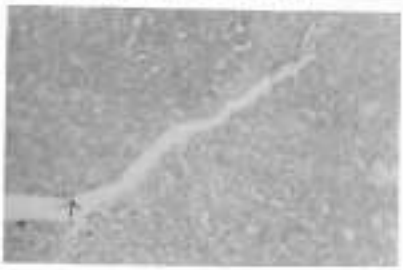

Fig-6

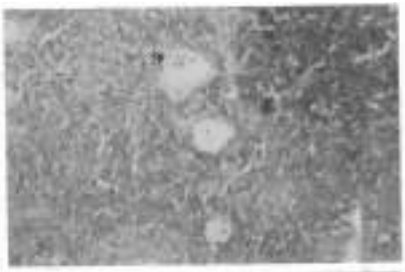

Fig-

Department, Zoology CCS University, which provides lab facility.

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EFFECTS OF MICROBIAL AND CHEMICAL FERTILIZERS ON VEGETATIVE AND REPRODUCTIVE CHARACTERISTICS OF SHIMLA MIRCH (*CAPSICUM SP.* LINN.) CV. GIANT BULLNOSE.

Surya Narayan

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

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ABSTRACT

To study the influence of organic and inorganic fertilizers on quality and yield components in mirch this trial was carried out. In boosting the productivity potential of plant, combined application of microbial and chemical fertilizers showed 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 were recorded. Maximum plant height (60.23 cm) was observed in Treatment-5 containing NPK+ Phosphobacteria (each 10g / pot). Similarly, the maximum number of flowers (32.25/ plant), the maximum number of fruits (13.33/plant), the highest number of branches (23.25/ plant), highest fruit weight (112.23g) and maximum total number of leaf (175.33 / plant) were also observed in treatment 5. 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: *Nutrition DAP, NPK, Urea Azospirillum, Phosphobacteria, chemical fertilizer and Shimla mirch.*

INTRODUCTION

Shimla mirch (*Capsicum sp.* Linn.*)* is now become a noblemen's vegetables.Its presence in the meal reflects the richness of the family. It is well responsive to nutrition and found to have great variability with varieties, and soil fertility. It is a climate choosy crop and specially prefers temperate climate. Now varieties are available which successfully can be grown subtropical and tropical climate too. It's voracious feeder crop therefore fertility 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. The important mirch growing countries in the world are India, Bangladesh, Pakistan, China, Cyprus, Egypt, Japan, Philippines, Syria and Western Europe (Anon 2001). In India, major mirch producing states are Himachal Pradesh, Uttarakhand, Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh (Anonymous, 2004). The varieties of shimla mirch have a narrow range of fruit shapes specially bell-shape with 4-5 protuberances at base. Fruit colour has limited variation, dominantly green, red and yellow. It is quite floriferous crop, with little attention of

nutrition and proper intercultural operation growers may improve their economic status.

MATERIALS AND METHODS

The experiment was carried out in a Completely Randomized Block Design (CRBD) at the Department of Horticulture, Kulbhasker Ashram Post Graduate College ,Allahabad during the year 2013-14. The mechanical compositions, physical and chemical properties of experimental soil, which was used for pot culture study was done.. The physical and chemical properties of soil 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 shimla mirch seeds were sown in one centimeter depth in the rows spaced at 10 cm and covered with thin layer of FYM. Thirty-days-old seedlings were transplanted into the trial pot. The treatments, were T-1 DAP+ Azospirillum (10g / pot),T-2 DAP+Phosphobacteria (10g / pot), T-3 DAP+Potassium mobilizer (10g / pot),T-4 NPK Mixture +Azospirillum (10g /pot), T-5 NPK mixture +Phosphobacteria (10g / pot), T-6 NPK mixture +Potassium mobilizer (10g / pot), T-7 Urea+ Azospirillum (each 10g /pot), T-8 Urea+ Phosphobacteria (each 10g / pot), T-9 Urea+ Potassium mobilize (10g / pot), T-10 Urea (Control). Five plants were selected randomly from plot to record yield contributing characters. All practical managements included; mulching, weeding and other agronomical 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 Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

It was observed that the application of microbial and chemical fertilizers as 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 fertilize were observed. Maximum plant height (60.23cm) were observed in T5 (Table1). The data on shoot length (32.25cm), and root length (51.65cm) as influenced by the combination of biofertilizers and chemical fertilizers showed significant differences among the treatments at all the crop stages. The highest number of branches per plant (23.25) was recorded in treatment T5 . Highest fruit weight was also observed in T5 (112.23g) Total number of leaf 175.33 per plant was too recorded in T-5. 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 (1620.23 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 shimla mirch were positively influenced by sources of nutrients applied. The maximum number of flowers (32.25/plant) and the maximum number of fruits (13.33/plant) was

recorded in T5 treatment. 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 plant height, number of leaves, number of branches and number of fruits due to influenced by environmental conditions and management practices was also observed. 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 and 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 affect drought tolerance and water-use efficiency. In addition, current study has showed that to optimum growth, crops need more potassium (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 might 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 *et. al*. (1998) found that the vegetative growth and yield of berry was the highest with the combined application of manures and fertilizers. For eggplant, the integrated use of 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 of these 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

Table.1 The effect of microbial and chemical fertilizer on vegetative characteristics of Shimla mirch plant. cv. Giant Bullnose.

Treatments	Plant height (cm)	Shoot length (cm)	Shoot /plant (no)	Leaves/plant (no)	Leaf area/plant (cm^2)	Root/plant (no)	Root length (cm)
T_1	45.11	16.01	9.21	110.12	1010.21	7.20	26.25
T_2	47.33	18.41	11.24	132.01	1220.25	9.22	28.22
T_3	46.12	17.01	10.21	120.11	1101.22	8.02	27.02
T_4	57.21	28.01	20.10	152.21	1400.20	18.23	48.36
T_5	60.23	32.25	23.25	175.33	1620.23	21.14	51.65
T_6	56.51	29.41	21.00	144.00	1345.01	19.02	47.25
T_7	40.44	26.00	6.25	85.33	850.23	4.35	31.36
T_8	43.25	27.02	7.23	90.23	900.25	5.36	34.44
T_9	41.21	25.22	6.89	86.65	860.56	4.55	32.25
T_{10}	35.23	10.64	2.54	45.65	465.85	2.56	21.68
MSE+_	8.25	4.22	2.14	12.02	45.36	1.20	3.36

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 (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

Table.2 The effect of microbial and chemical fertilizer on reproductive characteristics of Shimla mirch plant. cv. Giant Bullnose.

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	71.11	16.01	8.21	5.12	50.21	0.300	130.25
T_2	73.33	18.41	10.24	9.01	72.25	0.658	132.22
T_3	72.12	17.01	9.21	8.11	60.22	0.480	131.02
T_4	67.21	28.01	19.10	11.21	90.20	1.030	212.36
T_5	66.23	32.25	22.25	13.33	112.23	1.540	295.65
T_6	67.51	29.41	20.00	10.00	104.01	1.120	191.25
T_7	76.44	26.00	5.25	4.33	85.23	0.330	135.36
T_8	79.25	27.02	6.23	5.23	90.25	0.450	138.44
T_9	77.21	25.22	5.89	4.65	26.56	0.210	136.25
T_{10}	97.23	11.64	3.54	4.65	16.85	0.099	025.68
MSE+_	9.25	5.22	3.14	1.02	4.36	0.120	33.36

capable of mobilizing potash to plants in all types of soil especially, low K+ content soil. Such bacterial population in the soil can increase the availability of potash to the plants. Wange and Kale (2004) reported that, the results 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 morpho-physiological traits in shimla mirch is meager. Hence, there is a need to study the influence of organic and inorganic on quality and yield components in shimla mirch 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 shimla mirch. The benefit cost ratio was found lesser in

using both biofertilizer and chemical fertilizer compared to using chemical fertilizer alone in tomato crop cultivation.

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A STUDY ON ADULTERATION OF CURD SAMPLES COLLECTED FROM TRIBAL AND URBAN REGION

R. T. Raghuwanshi*, N. O. Khandare, N. A. Mankar*** and S. P. Verma******

*Agriculture Technical School, Dharni, Dist. Amravati. (U.P.), India

**Shri. Shivaji Agriculture College, Amravati, (U.P.), India

***Department of Agriculture Husbandry and Dairy Science, Shri. Shivaji Agriculture College, Amravati

****KAPG College, Allahabad- 211001 (U.P.), India

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ABSTRACT

Milk is most commercially sold commodity both by local vendor's as well super markets. In local products to increase the yield certain adulterants are added which may affect the nutritional quality of milk. Now a day's milk is adulterated with urea and Curd is popular throughout the state and need was felt to know the quality of Curd in terms of urea content. Hence the curd samples were tested for the presence of urea. It was observed that none of the laboratory Curd sample showed positive qualitative urea test. In contrast, four market Curd samples out of 40 samples exhibited positive test which worked out 10 % samples. Out of four samples, two were belonging to organized sector manufactures and two to vendor source. The positive samples stored at 30 ± 2^0C and 5 ± 1^0C temperature had shown positive test at the end of 5 and 35 days storage respectively. Therefore, it can be said that added urea in raw milk did not degrade during conversion of milk to Curd during storage either at room temperature or at lower temperature. Thus, this situation seems to be alarming for human health point of view, though the percentage of positive samples were comparatively lower.

Keywords : Milk, curd, adulteration

INTRODUCTION

Milk and milk products have establish a status of daily need commodity in the diet of all people. This situation, therefore, has been enchased and exploited by the milk producers. Curd is a dairy product obtained by coagulating milk in a process called curdling. The coagulation can be caused by adding rennet or any edible acidic substance such as lemon juice or vinegar, and then allowing it to sit. The increased acidity causes the milk proteins (casein) to tangle into solid masses, or *curds*.

Milk that has been left to sour (raw milk alone or pasteurized milk with added lactic acid bacteria) will also naturally produce curds. Curd commonly known as “Dahi” is popular throughout the state and need was felt to know the quality of Curd in terms of urea content. Milk and milk products could be easily adulterated either with liquid or solid

substances. Some of the adulterants are poisonous to health, though their residual effect is acted as slow poisoning in human body. Perhaps the profit oriented attitude might have tempted milk producers to adulterate milk, ignoring public health issue. Generally, genuineness of raw milk is examined at collection centers of dairies by employing lactometer test, which is commonly popular in rural areas as "Degree". In context the master minds of producers have develop their own system where, milk is firstly adulterated with water and then solids substances are added to adjust the consistency to cope-up lactometer reading with prescribed limits. The adulteration observed mostly in Milk, Curd, and Buttermilk and Butter and Ghee were adulterated with certain vendors in most of Milk and Curd the water content is more, but in few samples urea and starch was also observed. During seminar's and workshop a feed back is always given by the extension workers that in recent years milk producers have develop a tendency to add urea in milk as solid adulterant. In view of this, the present study was carried out to study the adulteration in curd specially in tribal area of melghat region Dist. Amravati, Maharashtra state in comparison to sample collected from urban area i.e. Amravati city. Now a day at Milk Schemes, qualitative test for the presence of urea is also carried out along with other quality control tests. Moreover, in order to create awareness in dairy business personnel. The procedure for determining the qualitative presence of urea in milk prescribed by Anonymous (2006).

MATERIALS AND METHODS

The samples collected from the tribal region market i.e. C_1S_1 - Dharni organized sector manufacture (OSM), C_1S_2 - Dharni vendor, and urban region market i.e. C_2S_1 - Amravati organized sector manufactures (OSM), C_2S_2 - Amravati vendor and curd prepared in the laboratory i.e. LS_3 -Laboratory samples were stored at room temperature (30 + 2^0C RH 50 to70%) and at refrigeration temperature (5 + 1^0C RH 85%). The samples stored at room temperature were analysed daily till it spoiled viz. for a period of five days, while the refrigeration samples were analysed at an interval of seven days till thirty-five days when it spoiled. Thus following treatments were formed in the study.

There were ten treatment combinations (5 sources x 2 temperature) on which the storage study was carried out in five replications. Urea in Curd was determined by the Biuret test given by N.K. Vishnoi (2006). Heating a small amount of Curd in a dry test tube and cool it. Added 2 ml of water for dissolving residue, add a drop of $CuSO_4$ solution and 2 ml NaOH solution, when a violet/green colour was obtained then urea is present. The laboratory work was carried out at Department of Animal Husbandry and Dairy Science, Shri. Shivaji Agriculture College, Morshi road, Amravati (MS)

RESULTS AND DISCUSSION

The Curd samples collected from the market of tribal region i.e. Dharni village and urban region i.e. Amravati city were tasted for the presence of urea. The observations obtained on qualitative presence are shown in Table -1. It was observed that the laboratory sample exhibited negative test for urea content. Probably use of milk from the known source, question of addition of urea does not arise. On the other hand out of the fresh 40 market samples, 4 samples were detected positive for urea content. This means, about 10% samples were containing urea. Thus, the results indicated alarming situation from public health

point of view, though the percentage of positive samples was comparatively low.

Moreover, out of the four positive samples two were belonging to organized sector manufacturer and two from vendor source. During collection of market samples, it was known from the organized sector manufacturers that they generally procured the raw milk from milk producers located around the cities or many times directly from the collection centers of co-operative societies. Under this procurement system it was just possible to have the raw milk with added urea. In contrast, the vendors produced the milk by rearing few milch animals and occasionally preferred to purchase the milk from outside sources. Obviously, this situation reduced the chances of raw milk with added urea. The similar type of study on adulteration in milk and milk products was also carried by J. K. Swathi and Naazia Kauser (2015), Monika G and M.P. Gupta (2008) and Shristhi Nirwal et. al. (2013)

The positive Curd samples stored at 30 + 2^0C and 5+1^0C were tasted at the end of the storage period i.e. 5 and 35 days respectively in order to ascertain the presence of urea. It is interesting to know that the stored samples were also exhibited positive test at both the temperatures. This means the added urea did not degrade during storage. Hence, its effect on the human health could be possible. Perhaps, urea might have formed peptide linkage with lactic acid, fatty acid, free fatty acids present in Curd and prolong storage at 5 + 1^0C might have develop easter of polyurolactate. Therefore, this could be the reason to observe the positive test for the presence of urea in stored samples. Secondly, the easily available nitrogen from urea could also favoured the growth of micro-organisms in general and YMC in particular. This contention is also confirmed from the fact that the market Curd samples exhibited more microbial load during storage as compared to laboratory Curd. Thus, the result on urea content calls upon the need to develop awareness in manufacturers and consumers about hazardous effect of urea on human body.

CONCLUSION

From the above study its evident that the curd samples collected were adulterated with common adulterants like urea which might be detrimental to human health, therefore a

Table 1 : Qualitative presence of urea in Curd

Source of Curd	Urea content		
	Presence	Absence	Total
Dharni OSM (C_1S_1)	+ 01	- 09	10
Dharni vendor (C_1S_2)	+ 02	- 08	10
Amravati OSM (C_2S_1)	+ 01	- 09	10
Amravati vendor (C_2S_2)	00	10	10
Laboratory samples (LS_3)	00	05	05
Grand total	**+ 04**	**- 41**	**45**

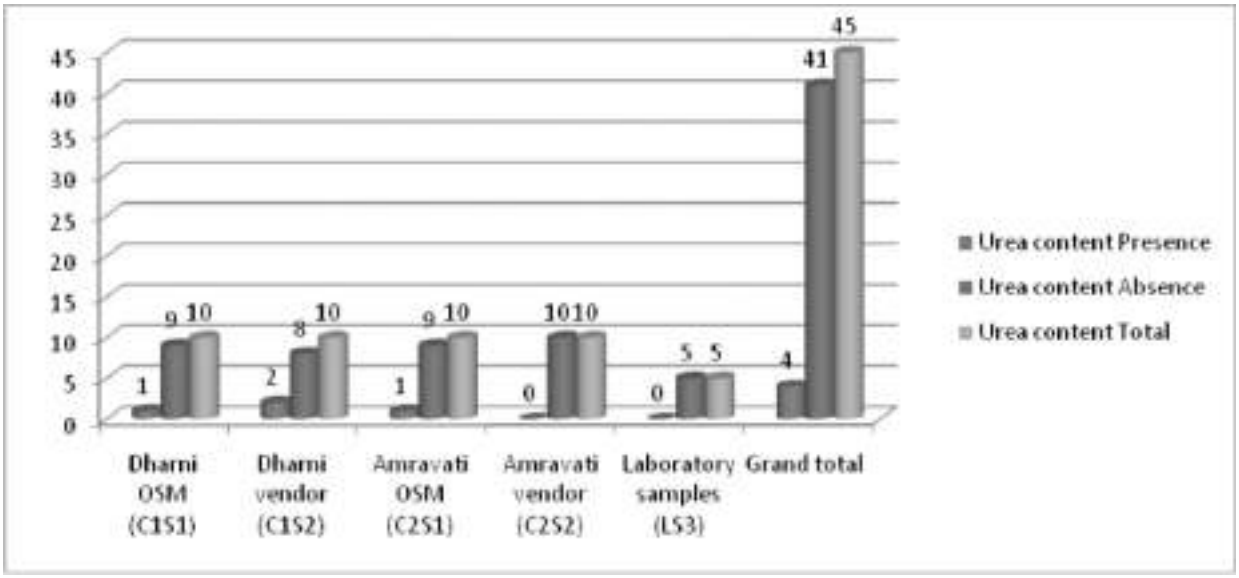

Fig. 1: Adulteration in curd samples

governing body should periodically check these products for presence of these harmful ingredients

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EFFECT OF DIFFERENT TREATMENTS ON PHYSICO-CHEMICAL PROPERTIES OF OSMOTIC DEHYDRATED GUAVA SLICE (*PSIDIUMGUAJAVA*)

Praveen Kumar, Vijay Bahadur and Balaji Vikram

Department of Horticulture

Sam Hingginbottom Institute of Agriculture, Technology & Sciences, Allahabad (U.P.), India

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ABSTRACT

The aim of this study was to evaluate the effect of osmotic dehydration of guava slice. The present investigation entitled "Effect of different treatments on physico-chemical properties of osmotic dehydrated guava slice (*Psidium guajava*)" was carried out in the Post Harvest Laboratory of Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad in 2012. The design of the experiment was Completely Randomized Design (CRD) with 10 treatments and 3 replications and stored for 90 days under ambient temperature. The variety of guava was Allahabad safeda. The experimental result was found significant and it may be concluded that T_5 (Dipping of blanched Guava slices in 60^0 Brix glucose for 12 hours followed by vacuum dehydration) gave the best result in total soluble solids (23.53^0Brix), acidity (0.34%), non-reducing sugar (5.82%) and also excellent in organoleptic quality.

Key Words: Guava, osmotic dehydration, blanching.

INTRODUCTION

Guava (*Psidium guajava)* is an evergreen sub-tropical fruit crop and it belongs to the family Myrtaceae. It is originated in Tropical America region extending from Peru to Chile. It is also known as "Apple of tropics". Guava is one of the common and major fruit crops of India and considered as fourth most important fruit in area and production. In India, it occupies an area of 1.62 million hectares with an annual production of 16.85 million tonnes accounting for 5.26 percent and 3.87 percent of area and production respectively (NHB, 2014). Though it is successfully grown all over the country, the most important guava growing states are Uttar Pradesh, Bihar, Madhya Pradesh and Maharashtra. Uttar Pradesh is by far the most important guava producing state of India, and Allahabad has the reputation of growing the best guava in the country as well as in the world. Guava is a rich source of ascorbic acid (300mg/100g) and pectin. The ripe fruits contain moisture (77.9-86.9%), dry matter (12.3-26.3%), ash (0.51-1.02%) crude fat (0.10-0.70 %), crude protein (0.82-1.45%) and crude fibre (2.0-7.2%). Guava fruit is relished when mature or ripe and freshly plucked from the tree. Excellent salad and pudding are prepared from

the shell of the ripe fruit. It can be preserved by canning as halves or quarters, with or without seed core. Guava slices can be dehydrated by air drying or osmotic dehydration and the dehydrated slices are pulverized to obtain guava fruit powder which is a good source of vitamin C. It freezes exceptionally well and the frozen product is practically indistinguishable from fresh fruit.

Drying and dehydration is the removal of majority of water contained in the fruits or vegetables and is the primary stage in the preparation of dehydrated fruits and vegetables. In osmotic dehydration, the fruits are subjected to osmosis by dipping or spreading them in concentrated sugar syrup under specific condition, so that the water from the fruits migrates to sugar syrup. Major dehydration of the fruits takes place in this process step, the final dehydration of guava slices to make it suitable for marketing is carried out by cabinet drying.

MATERIALS AND METHODS

The present investigation entitled "Effect of different treatments on physico-chemical properties of osmotic dehydrated guava slice (*Psidiumguajava*)" was carried out in the Post Harvest Laboratory of Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad during 2012. The experiment was carried out in the Completely Randomized Design (CRD) with 16 treatments and 3 replications and stored for 90 days under ambient temperature.

T_0 : Control

T_1 : Dipping of blanched Guava slices in 50^0 Brix sucrose for 12 hours followed by vacuum dehydration

T_2 : Dipping of blanched Guava slices in 60^0 Brix sucrose for 12 hours followed by vacuum dehydration

T_3 : Dipping of blanched Guava slices in 70^0 Brix sucrose for 12 hours followed by vacuum dehydration

T_4 : Dipping of blanched Guava slices in 50^0 Brix glucose for 12 hours followed by vacuum dehydration

T_5 : Dipping of blanched Guava slices in 60^0 Brix glucose for 12 hours followed by vacuum dehydration

T_6 : Dipping of blanched Guava slices in 70^0 Brix glucose for 12 hours followed by vacuum dehydration

T_7 : Dipping of blanched Guava slices in 50^0 Brix sugar for 12 hours followed by vacuum dehydration

T_8 : Dipping of blanched Guava slices in 60^0 Brix sugar for 12 hours followed by vacuum dehydration

T_9 : Dipping of blanched Guava slices in 70^0 Brix sugar for 12 hours followed by vacuum dehydration

SENSORY EVALUATION

The sensory evaluation for assigning scores for the samples were conducted by a panel of five judges and the product was rated on a 9-point Hedonic scale (Amerine *et.al,* 1965). The judges were kept same to all organoleptic tests.

The attributes considered in the score were given below:

Examine the colour and appearance, texture, flavor and taste and the overall acceptability of the sample.

FLOW CHART FOR THE PREPARATION OF OSMOTIC DEHYDRATED GUAVA SLICES

Selection of fresh, ripe guava fruits

↓

Washing and removal of seeds core

↓

Cutting into 1 cm thick slices

↓

Dipping in 60^0 Brix /70^0Brix sucrose for 12 hours

↓

Shade drying for 1 hour after taking out from solution

↓

Guava slices are loaded on trays for cabinet drying and dried at 60^0-70^0C for 4 hrs/5 hrs/6hrs/7hrs/8hrs/9hrs based on different treatments

↓

Dried guava slices are packed in LDPE and sealed

↓

Store in plastic jar in dry place

RESULTS AND DISCUSSION

Moisture content (%): At initial reading, the minimum moisture content (23.88%) was noted with T_9 and maximum (29.40%) was in T_2. At 30 DAS, the minimum moisture content (23.99%) was determined with T_5 and maximum (29.53%) was found in T_2. At 60 DAS, an identical trend was achieved where T_5 again with lowest moisture content (24.11%) and highest (29.71%) was noted with T_2. At 90 DAS, T_5 remained with lowest moisture content (24.20%) and highest (29.89%) was found in T_2. The moisture content of dehydrated guava slices samples showed a gradually increased trend. This may be concluded to a simple fact that the dehydrated guava slices also went through the natural physiological process of respiration which has forced the slices to absorb moisture in the storage period. Similar observations were also reported by Vieira (2012) and Khurdiya and Roy (2011) related to guava powder.

Total Soluble Solid (%): At initial reading, maximum TSS (23.10^0 Brix) was noticed with T_5 while minimum (10.77^0 Brix) was found with T_2. At 30 DAS, the maximum TSS (23.27^0 Brix) was observed with T_5 and minimum with T_2 (11.03^0 Brix) followed by T_4 (12.10^0 Brix). A similar trend was found 60 DAS, where again the maximum TSS (23.43^0 Brix) was noticed with T_5 followed by T_4 (22.07^0 Brix) and minimum with T_3 (11.17^0 Brix). Similar trend was also noticed at 90 DAS, where T_5 was with maximum TSS (23.53^0 Brix) and minimum with the treatment T_2 (11.27^0 Brix). Total soluble solids were found significantly increasing with the increase in the sucrose and honey percent. Similar findings were also reported by Ahmad and Choudhary (2014) and Kumar (2010) in papaya.

Acidity (%): At initial stage, the minimum acidity (0.11%) was noticed in T_5 and maximum (0.38%) was found in T_2 followed by T_3 (0.37%). At 30 DAS, the minimum titrable acidity was found in the treatment T_5 (0.13%) and maximum was found in T_3 (0.54%) by T_1 (0.53%). At 60 DAS, minimum acidity (0.23%)

was found in T_5 and maximum (1.34%) in T_1 followed by T_3 (1.27%). After 90 DAS, a similar trend was found, where minimum acidity was with T_5 (0.34%) and T_3 was with maximum acidity (1.85%) followed by T_8 (1.74%). The increased acidity in dehydrated guava slices in storage period may be the combined effect of physiological reactions and storage duration. The lower acidity value observed in osmotic dehydration due to leaching of acids from the prepared fruits by osmosis as studied by Chaudhari *et al.* (2003).

Ascorbic acid (mg/100gm): At initial stage, the maximum ascorbic acid (175mg/100g) was found with the treatment T_8 followed by T_9 (166.52mg/100g) and minimum in T_2 (140.17mg/g). 30 DAS, similar trend was recorded as the maximum ascorbic acid (173.26mg/100g) was recorded with the treatment T_7 followed by T_6 (163.16mg/100g) and minimum in T_2 (135.20 mg/100g). After 60 DAS, again T_8 was with highest ascorbic acid (171.56mg/100g) followed by T_9 (161.22mg/100g) and lowest in T_2 (130.83mg/100g). Similar trend was found at 90 DAS where the maximum ascorbic acid (169.52mg/100g) was reported in T_8 followed by T_9 (161.11mg/100g) and minimum in treatment T_2 (124.43mg/100g). It was clearly shown that the samples treated with honey were with high content of ascorbic acid and T_{11} emerged as superior among all treatments. Henmaker *et al.* (2000) also reported the trend of reducing ascorbic acid from mango guava sheets stored under ambient conditions during a period of 6 months.

Reducing sugar (%): At initial stage, the maximum reducing sugar (6.09%) was found in T_3 followed by T_7 (5.91%) and minimum in T_6 (3.06%). After 30 DAS, T_3 was again with highest reducing sugar (6.18%) followed by T_7 (6.03%) and lowest in T_6 (3.16%). At 60 DAS, same trend was found where T_3 was with maximum reducing sugar (6.23%) followed by T_7 (6.12%) and minimum in T_6 (3.25%). An identical trend was again achieved at 90 DAS, where the highest reducing sugar (6.30%) was reported in T_3 followed by T_7 (6.20%) and lowest in T_6 (3.34%). This may be due to the breakdown of polysaccharides into simple sugars as reported by Siddappa and Bhatia (2015) in orange juice. A similar report was observed by Kumar and Khurdiya (2015) in mango slices.

Non reducing sugar (%): At initial stage, the highest percentage of non-reducing sugar (5.63%) was with T_6 followed by T_5 (5.53%), T_8 (5.43%) and lowest (4.42%) was with T_3 and T_4. At 30 DAS, T_6 was again with maximum non-reducing sugar (5.71%) followed by T_9 (5.60%) and minimum with T_3 (4.48%). A similar trend was found after 60 DAS where the highest non-reducing sugar (5.78%) was with T_6 followed by T_9 (5.66%) and lowest with T_3 (4.56%). After 90 DAS, again T_6 remained significantly superior with highest non-reducing sugar (5.82%) followed by T_8 (5.73%) and minimum in T_3 (4.64%). Similar results of increased sugar levels in fruits treated with sugar syrup have been reported by Nagaraju (2010) in ber and Kustagi (2002) and Chandan (2004) in aonla.

Total sugar (%): At initial stage, the maximum total sugar (10.87%) was noticed with the treatment T_7 followed by T_8 (10.72%) and minimum with T_2 (8.22%). After 30 DAS,

the highest total sugar (11.15%) was noticed with T_7 followed by T_8 (10.93%) and lowest was noticed with T_2 (8.42%). An identical trend was reported at 60 DAS, where T_7 was again with maximum total sugar (11.37%) followed by T_8 (11.13%) and minimum was in T_2 (8.58%). After 90 DAS, a similar trend was noticed where again the highest percentage (11.54%) of total sugar was with T_7 followed by T_8 (11.37%) and lowest with T_2 (8.86%). This clearly showed that T_7 remained superior among all the treatments of dehydrated guava slices during 90 days of storage. The samples of dehydrated guava slices treated with sucrose emerged superior as compared to that of honey. A similar report was observed by Thakur and Sawant (2008) in osmotic dehydrated pineapple slices.

Sensory evaluation: The panel of judges was kept same for all organoleptic tests. At initial test, T_5 was with highest score for colour and appearance (9.00) followed by T_4 (8.90). Highest score (9.00) for texture, flavour and taste and overall acceptability were obtained in T_5 and T_4 followed by T_9 (8.60). At 30 DAS, T_5 was again with maximum score (9.00) for colour and appearance followed by T_5 (8.80). For texture, flavour-taste and overall acceptability, the highest score was found in T_5, i.e (9.00), (8.70), (9.00) followed by T_5 (8.95), (8.50), (8.90) respectively. After 60 DAS, for colour and appearance and texture, T_5 was again with highest score (8.70), (8.75) followed by T_4 (8.50), (8.65) respectively. For flavour and taste and overall acceptability, the highest score was with T_5 (8.55), (8.70) followed by T_4 (8.45), (8.60) respectively. After 90 DAS, an identical trend was again noticed where T_5 remained significantly superior with highest score for colour and appearance (8.50) followed by T_4 (8.35). For texture, T_5 was reported with highest score (8.60) followed by T_4 (8.50). The highest score for flavour-taste (8.40) was again with T_5. An identical trend was found at 90 DAS where the highest score for overall acceptability (8.65) was again with the treatments T_5 followed by T_8 (8.55). Duangmal and Khachonsakmetee (2009) observed similar report in osmotic dehydrated guava.

Table 1: Effect of different treatments on various parameters of dehydrated guava slices during storage.

Treatment	Moisture				Total Soluble Solids				Acidity (%)				Ascorbic acid (mg/100g)			
	Initial Reading	30 Days	60 Days	90 Days	Initial Reading	30 Days	60 Days	90 Days	Initial Reading	30 Days	60 Days	90 Days	Initial Reading	30 Days	60 Days	90 Days
T_0	26.17	26.42	26.75	27.31	14.53	14.77	14.87	15.07	0.26	0.31	0.54	0.65	144.73	139.54	135.58	129.45
T_1	24.23	24.34	24.46	24.66	14.80	15.07	15.20	15.30	0.23	0.27	0.49	0.60	140.17	135.20	130.83	124.43
T_2	29.40	29.53	29.71	29.89	10.77	11.03	11.17	11.27	0.38	0.54	1.27	1.74	163.56	161.14	158.88	129.45
T_3	27.21	27.39	27.53	27.62	12.03	12.10	12.20	12.30	0.37	0.53	1.34	1.85	160.52	158.28	152.18	124.43
T_4	25.57	25.93	26.19	26.48	18.80	18.97	19.13	19.23	0.15	0.19	0.30	0.38	148.52	145.11	140.66	157.30
T_5	23.90	23.99	24.11	24.20	23.10	23.27	23.43	23.53	0.11	0.13	0.23	0.34	142.66	140.18	136.55	147.16
T_6	27.79	27.92	28.06	28.16	12.67	12.80	12.90	13.13	0.27	0.32	0.45	0.56	160.57	156.27	152.46	137.65
T_7	26.99	27.16	27.31	24.45	15.03	15.20	15.33	15.43	0.24	0.34	0.46	0.61	155.67	152.42	148.28	132.62
T_8	25.30	25.45	25.57	25.63	20.90	21.07	21.13	21.33	0.15	0.22	0.35	0.42	158.65	156.58	155.34	151.19
T_9	23.88	24.02	24.17	24.25	21.13	21.23	21.37	21.50	0.13	0.20	0.29	0.37	157.56	155.82	152.66	144.62
F- test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
S. Ed. (±)	0.99	0.99	0.98	1.342	0.1	0.01	0.00	0.00	0.00	0.00	0.04	0.00	0.205	0.16	0.18	0.12
C. D. at 5%	2.04	2.03	2.02	4.82	0.16	0.15	0.13	0.14	0.05	0.04	0.08	0.12	2.925	0.839	0.881	0.718

CONCLUSION

Analysis of both physical and chemical characteristics of vacuum dehydrated of guava suggests that the inclusion of glucose has a strong impact on the changes in both texture and colour. It is concluded from the present investigation that the treatment T_5 (Dipping of blanched Guava slices in 60^0 Brix glucose for 12 hours followed by vacuum dehydration) was found most suitable in terms of quality and sensory scores in 3 months of storage.

Table 2: Effect of different treatments on various parameters of dehydrated guava slices during storage.

Treatment	Reducing Sugar (%)				Non-Reducing sugar (%)				Total sugar (%)				Colour and Appearance			
	Initial Reading	30 Days	60 Days	90 Days	Initial Reading	30 Days	60 Days	90 Days	Initial Reading	30 Days	60 Days	90 Days	Initial Reading	30 Days	60 Days	90 Days
T_0	3.37	3.43	3.52	3.60	4.96	5.12	5.25	5.36	8.33	8.55	8.77	8.96	7.20	7.10	7.05	6.90
T_1	3.16	3.26	3.34	3.50	5.06	5.16	5.24	5.36	8.22	8.42	8.58	8.86	7.40	7.35	7.20	7.05
T_2	6.09	6.18	6.23	6.30	4.42	4.48	4.56	4.64	9.74	9.88	10.13	10.48	6.35	6.25	6.20	6.00
T_3	5.22	5.28	5.42	5.75	4.42	4.52	4.62	4.71	9.64	9.80	10.04	10.46	6.45	6.30	6.15	6.05
T_4	3.43	3.49	3.61	3.68	5.42	5.50	5.59	5.65	8.85	8.99	9.20	9.33	8.90	8.80	8.50	8.35
T_5	3.06	3.16	3.25	3.34	5.63	5.71	5.78	5.82	8.68	8.95	9.14	9.36	9.00	9.00	8.70	8.50
T_6	5.91	6.03	6.12	6.20	4.97	5.13	5.25	5.34	10.87	11.15	11.37	11.54	7.50	7.35	7.25	7.10
T_7	5.73	5.83	5.92	6.07	4.99	5.11	5.21	5.30	10.72	10.93	11.13	11.37	7.25	7.10	7.08	7.00
T_8	3.24	3.36	3.44	3.53	5.47	5.55	5.64	5.72	8.71	8.91	9.08	9.25	8.20	7.75	7.20	7.10
T_9	3.17	3.26	3.39	3.48	5.53	5.60	5.66	5.73	8.70	8.86	9.05	9.21	8.30	7.50	7.25	7.20
F- test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
S. Ed. (±)	0.0	0.00	0.00	0.12	0.0	0.00	0.00	0.00	0.09	0.00	0.13	0.09	0.00	0.00	0.00	0.00
C. D. at 5%	0.06	0.07	0.10	0.72	0.08	0.04	0.05	0.04	0.62	0.04	0.75	0.61	0.05	0.04	0.04	0.04

Table 3: Effect of different treatments on various parameters of dehydrated guava slices during storage.

Treatment	Texture				Flavour and Taste				Overall Acceptability			
	Initial Reading	30 Days	60 Days	90 Days	Initial Reading	30 Days	60 Days	90 Days	Initial Reading	30 Days	60 Days	90 Days
T_0	7.15	7.05	7.00	7.00	7.90	7.75	7.50	7.30	8.60	8.60	8.30	8.25
T_1	7.25	7.05	7.00	6.90	7.95	7.80	7.60	7.45	8.70	8.70	8.45	8.30
T_2	6.65	6.45	6.30	6.25	6.50	6.30	6.25	6.05	7.20	7.05	6.70	6.05
T_3	6.45	6.30	6.20	6.05	6.65	6.40	6.20	6.00	7.30	7.00	6.65	6.00
T_4	9.00	8.95	8.65	8.50	9.00	8.50	8.45	8.30	9.00	8.90	8.60	8.50
T_5	9.00	9.00	8.75	8.60	9.00	8.70	8.55	8.40	9.00	9.00	8.70	8.65
T_6	7.50	7.35	7.20	7.05	8.30	8.20	8.15	8.05	8.40	8.40	7.85	7.50
T_7	7.45	7.25	7.05	7.00	8.40	8.25	8.20	8.10	8.45	8.45	7.90	7.60
T_8	8.60	8.45	8.25	8.15	8.60	8.55	8.40	8.30	8.80	8.80	8.60	8.55
T_9	8.45	8.30	8.15	7.95	8.75	8.60	8.45	8.35	8.85	8.85	8.70	8.65
F- test	S	S	S	S	S	S	S	S	S	S	S	S
S. Ed. (±)	0.00	0.18	0.05	0.05	0.06	0.10	0.00	0.00	0.05	0.06	0.00	0.00
C. D. at 5%	0.03	0.87	0.44	0.44	0.51	0.64	0.07	0.12	0.45	0.50	0.13	0.12

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INDUCED IRREGULARITIES IN MICROS POROGENESIS IN LINSEED (*LINUM USITATISSIMUM* L.)

Saroj Pandey and Girjesh Kumar

Plant Genetics Laboratory, Department of Botany, University of Allahabad, Allahabad - 211 002 (U.P.), India

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ABSTRACT

Irregular microsporogenesis and mode of reproduction are described in *Linum usitatissimum* L. of family-Linaceae due to hazardous effect of different doses of gamma-rays i.e. 100Gy, 200Gy, 300Gy, 400Gy and 500Gy. Cytological analysis revealed that the elimination of micronuclei, microcytes formation and cytomictic microsporogenesis was revealed almost at the each stage of meiosis and the further meiotic behaviors were highly irregular as well. Most meiotic anomalies were related to irregular chromosome segregation commonly found due to cytomixis and microcyte formation. Some micronuclei remained as terad, whereas other released as micocyte from spore wall. Other meiotic abnormalities, such as Dyads, tetrads and hexads with micronuclei and microcyte formation due to cell fusion and the absence of cytokinesis were also recorded. Restitution nucleus leads to the formation of binucleate microspore or 2n microspores were also recorded. This is first time reported that meiotic instability and pollen sterility caused at different doses of gamma rays in *Linum usitatissimum* L.

Keywords: Microsporogenesis, hazardous effect, hexads, 2n microspores, restitution nucleus, meiotic instability.

INTRODUCTION

Chromosomal rearrangements are one of the most frequently produced classes of mutation that result from the action of both physical and chemical mutagenic agents (Gecheff, 1996). In higher plants, chromosome aberrations induced by radiation have been utilized for many years in classical genetic studies (Mc clintock, 1984) and more recently to provide starting material for gene isolation and mapping (Liharska et al., 1997; Bhatt et al., 2001).

In studies with gamma rays, mainly seeds were used for the induction of chromosomal variation (Brock, 1980; Friebe et al., 1991; Sanamyan et al., 2000). However, they can yield chimeras, which hinder the analysis of mutations of the M1 generation (Brock, 1980).

Gamma-irradiation is one of the main physical mutagen for mutation studies in plants or any other techniques related with irradiation. Mutagens have been effective in decreasing the mitotic index (Savaskan and Toker, 1991) or increasing micronuclei number and pollen

abnormalities (Mehetre and Thombre, 1981; Giles and Prahash, 1987; Savaskan and Atila, 1991).

Meiosis is an event of high evolutionary stability that culminates in the reduction of chromosome number in gametes. Cytological events of meiosis are controlled by a large number of genes acting from pre-meiosis to the post-meiotic mitoses (Baker et al., 1976; Golubovskaya, 1979, 1989).

Mutations of these genes may cause anomalies that impair plant fertility (Albertsen and Phillips, 1981; Curtis and Doyle, 1991). When an allogamous plant is submitted to self-pollination, many genes, including those involved in the control of meiosis, experience homozygosis causing inbreeding depression. Irregularities in microsporogenesis due to inbreeding have been reported in several plant species (Lamm, 1936; Myers and Hill, 1943; Morris and Isikan, 1964; Pantulu and Manga, 1972; Karp and Jones, 1982; Defani-Scoarize et al., 1995, 1996; Pagliarini et al., 2002).

MATERIALS AND METHODS

The seeds of Linseed were procured from Chandrasekhar Azad University, Kanpur. The seeds were treated at different doses of ã-rays i.e. 100Gy, 200Gy, 300Gy, 400Gy and 500Gy from Co-60 source at NBRI, Lucknow. Within 24 hrs of gamma radiation the seeds were sown in pots along with control .At the time of flowering, buds were fixed in carnoy's fixative (1:3 acetic acid: absolute alcohol solution) and were transferred into 70% alcohol for 24 hour. Cytological analysis was conducted using 2% acetocarmine. Pollen fertility was also evaluated by using acetocarmine-glycerin stain ability test.

RESULTS AND DISCUSSION

Meiotic studies of *Linum usitatissimum* L. revealed that (2n=15) in control-set was normal at diakinesis (Figure1). First report on owing to the condition, of gamma rays treatment, the meiotic behavior by treatment of the gamma-rays was abnormal, as can be seen in (Table 1). Some abnormalities, such as irregular chromosome segregation in both divisions of meiosis leading to micronucleus formation, which eliminated as microcytes at prophase, metaphase and anaphase (Figure 2,3 and 4), are a common feature seen in the treatment of gamma rays.

Another abnormality recorded was related to cell fusion. Microcytes also appearing when cytomixis or cell fusion occurring between two or many cells. Two or three cells fused at the earlier stages of prophase I (Figure7, 8 and 9). Three cells were fused at earlier stage of prophase I (Figure 2, Figure16, 17and18). Microcyte also formed when cytomixis occurring between monad and pollen mother cells (Figure22).

In the present case, the behavior of chromosomes that failed to participate in telophase nuclei were characteristic in certain cells, although in others they remained as micronuclei. In certain cells the micronuclei approached the cell wall (Figure5) and during the first cytokinesis they were kept isolated from the sister cells by an extra cytokinesis, which produced microcytes (Figure5). Restitution nuclei were formed in cells that did not undergo cytokinesis (Figure 6).

These microcytes remained in this condition until the end of meiosis. As some micronuclei remained in the cytoplasm after telophase I, they produced microcytes (Figure 11) after telophase II by means of one extra cytokinesis (Figure12) or remained as micronuclei and these micronuclei eliminated as microcyte in the microspores of the dyad,

tetrad, and hexad (Figure19, 20 and 21). Such behaviors were responsible for different kinds of meiotic products.

With increasing dose of treatment of gamma-rays, percentage of abnormal PMCs were increased i.e. 15.3 to 51.4% from 100 Gy to 500 Gy (Table 1). Percentage of sterile pollen grains were also increased i.e. 56.0, 79.8, 80.6, 85.9 and 92.0 at the treatment dose of 100 Gy, 200Gy, 300Gy, 400Gy and 500 Gy respectively (Table 2), whereas in control the percentage of sterile pollen grains were observed to be 1.83%.

The percentage of abnormal cells increased as the radiation doses increased. Results like these have been reported by many authors (Zeerak, 1992; Ahmad, 1993 and Khare, 1994). Cytomixis affected the meiotic course considerably, resulting in pollen malformation and pollen grains of heterogeneous sizes. The frequency of chromatin transfer in such individuals was much higher during the first meiotic division than the second, which is in agreement with earlier findings (De and Sharma, 1983; Consolaro and Pagliarini, 1995; de Souza and Pagliarini, 1997; Pierozzi and Benatti, 1998). Transfer of chromatin, either partial or complete, determines the fate of the PMCs involved in cytomixis – whether these result in aneuploids or polyploids or anucleated forms. The formation of such PMCs as a consequence of cytomixis has also been noticed earlier by other workers (Gottschalk, 1970; Ashraf and Gohil, 1994; Dagne, 1994; Poggio *et al*., 1997; De Souza and Pagliarini, 1997). The extra chromatin masses present in the PMCs do not pair with the main chromatin and remain in the cell as a separate mass. The fate of such additional masses of chromatin is not known, but they probably form micronuclei or micropollen as suggested by (Bhat *et al.,* 2006). The role of cytomixis in inducing such meiotic irregularities has been reported in other plants as well (Mary, 1979; Chauhan, 1981; Mary and Suvarnalatha, 1981, Singhal and Gill, 1985).

The present study reveals that cytomixis is directly responsible for abnormal meiotic behaviour, pollen grains of different sizes and pollen sterility in *M. aculeata*. Similar findings regarding the effects of cytomixis on meiotic course have been reported in *Coix* (Sapre and Deshpande, 1987), *Alopecurus arundinaceus* (Koul, 1990), *Polygonum tomentosum* (Haroun, 1995), *Hordeum vulgare* (Haroun, 1996), *Brassica napus* var. *oleifera* and *B. campestris* var *oleifera* (Alice and Maria, 1997), and *Vicia faba* (Haroun *et al.,* 2004). Sharma and Gaur (1987) Cytoplasmic connections among pollen grains were also observed in some individuals in this study. Such connections among pollen grains had already been noticed in the intergeneric hybrids of *Roegneria tsukushiensis* x *Psathyrostachys huashanica* and *Triticum aestivum* x *Psathyrostachys huashanica.*

All these abnormalities lead to micronuclei formation at the end of first and second division what could affect the final product of meiosis. The fate of micronuclei in higher plants may be diverse. In some species the micronuclei originated during meiosis remain as such in the tetrad stage, whereas they form microcytes. After microspore formation micronuclei were eliminated by a curious mechanism in which one or more micronuclei approached the microspore wall and formed a kind of bud which separated from the microspore and was eliminated as a microcyte that gave rise to small, sterile, pollen grains (*Flávia Roseli Baptista-Giacomelli1, Maria Suely Pagliarini1 and Juliano Luiz De AlMeida,* 2000).

CONCLUSION

From the above study we can conclude that the gamma- rays poses harmful threats on pollen fertility of plant of *Linum usitatissimum* L. at different doses from 100Gy to 500 Gy, that leads to the chromosome elimination, cytomictic PMCs formation, formation of

Table 1. Frequency of meiotic abnormalities in *Linum usitatissimum* L. at different doses of gamma-rays treatment.

Treatment	Number of PMCs analyzed	Number of abnormal PMCs analyzed	PMCs with Microcyte at Prophase	PMCs with Microcyte at Metaphase I/II	PMCs with microcyte at Anaphase I/II	PMCs with microcyte at Telophase I/II	PMCs with cytomixis and microcyte at Prophase	PMCs with Cytomixis and microcyte at Metaphase I/II	PMCs with cytomixis and microcyte at Anaphase I/II	PMCs with cytomixis and microcyte at Telophase I/II	Monad with micro nuclei and microcyte	Dyad with micronuclei and microcyte	Tetrad with micronuclei and microcyte	Hexad with micronuclei and microcyte
Control	225	-	-	-	-	-	-	-	-	-	-	-	-	-
100 Gy	320	50 (15. 3%)	6	10	8	8	3	4	3	2	1	2	2	1
200 Gy	321	64 (19.9%)	8	11	10	9	4	6	5	3	2	2	2	1
300 Gy	298	70 (23.4%)	6	14	12	7	3	9	2	4	4	3	3	3
400 Gy	256	96 (37.08%)	9	16	15	9	5	11	4	4	6	5	4	6
500 Gy	254	132 (51.4%)	5	20	17	16	9	15	7	9	12	10	9	13

Table 2. Frequency of Pollen-sterility in *Linum usitatissimum* L. at different doses of gamma-rays treatment.

Treatment	Microspore*	Sterile Pollen grains*
Control	218	4 (1.83%)
100 Gy	225	125 (56.0%)
200 Gy	248	198 (79.8%)
300 Gy	268	216(80.6%)
400 Gy	285	245(85.9%)
500 Gy	325	299 (92.0%)

restitution nucleus or 2n spore without cytokinesis and detached microcyte formation which is responsible for meiotic instability and pollen sterility in *Linum usitatissimum* L.

EXPLANATION OF FIGURE

Figure 1. (2n=15) in control-set was normal at diakinesis.

Figure 2. Micronucleus formation, which eliminated as microcytes at prophase.

Figure 3. Micronucleus formation which eliminated as microcyte at metaphase.

Figure 4. Micronucleus formation which eliminated as microcyte at and anaphase.

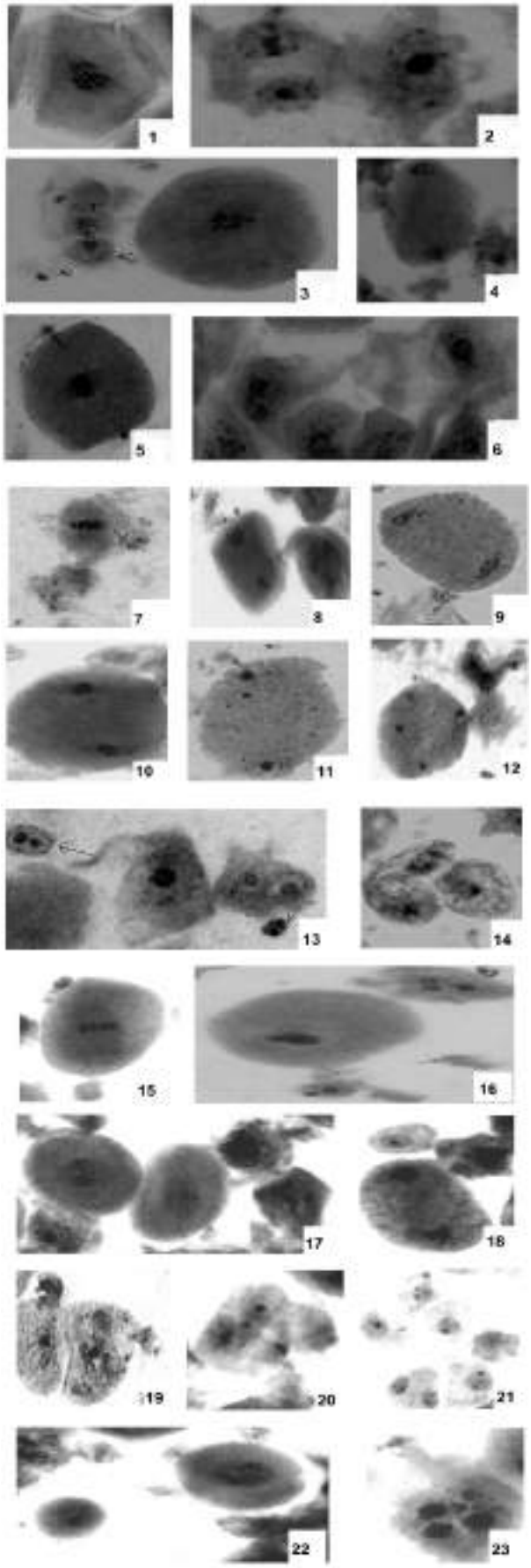
Figure 5. Certain cells the micronuclei approached the cell wall and during the first cytokinesis they were kept isolated from the sister cells by an extra cytokinesis, which produced microcytes.

Figure 6. Restitution nuclei were formed in cells that did not undergo cytokinesis.

Figure 7. Microcyte formation at the cytomictic stage between two PMCs at Metaphase and Multinucleate stage.

Figure 8. Microcyte formation at the cytomixis between two PMCs at Anaphase and Trinucleate stage.

Figure 9. Microcyte formation at the Anaphase



stage.

Figure10. Microcyte formation at Telophase I.

Figure11. Some micronuclei remained in the cytoplasm after telophase I.

Figure12. They produced microcytes, after telophase II by means of one extra cytokinesis.

Figure13. Microcyte formation during cytomixis between three PMCs.

Figure14. Microcyte formation during cytomixis between two PMCs.

Figure15. Microcyte formation at Metaphase.

Figure16. Microcyte formation at the fusion of three cells at earlier stage of prophase I.

Figure17. Microcyte formation at the fusion of four cells at prophase and metaphase stage.

Figure18. Microcyte formation at the fusion of two cells at Anaphase and Prophase stage.

Figure 19. Micronuclei eliminated as microcyte in the microspores of the dyad.

Figure 20. Micronuclei eliminated as microcyte in the microspore of the tetrad.

Figure 21. Micronuclei eliminated as microcyte in the microspore of the hexad.

Figure 22. Microcyte also formed when cytomixis occurring between monad and pollen mother cells.

Figure 23. Micronuclei and microcyte formation at Tetranucleate stage.

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EFFECT OF PHOSPHORUS AND FOLIAGE APPLID SULPHUR ON GROWTH AND YIELD OF GREEN GRAM (VIGNA RADIATA) UNDER RAINFED CONDITIONS OF CHITRAKOOT AREA

U.S Mishra, Rajesh Dhakar and Ravi Shankar Mishra
Department of Natural Resource Management, Faculty of Agriculture
Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.), India

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ABSTRACT

The field experiment was conducted during kharif season of 2013 at rajola farm M G C G V V Chitrakoot, satna (MP) to study on the effect of Phosphorus and sulphur on growth and yield of green gram. Application of phosphorus up to 40 kg/ha along with 2% spraying of sulphur proved the best fertility level for growing green gram variety samrat under rainfed conditions of Chitrakoot area. The grain yield was found significantly higher up to 11.90 qt/ha. The treatment interaction was found significantly.

Keywords : Green graam, phosphorus, sulphur

INTRODUCTION

Green gram commonly known as moong is one of the important pulse crops in India. the high yield varieties of green gram presently available hold great promise for bridging the gap between the present per capita availability of pulses (35g) in the country and the standard set by W. H. O. however this is possible only when adequate and balanced supply of phosphorus and sulphur are provide because both these nutrient are required in the large quantities by legumes .In recent years phosphorus and sulphur deficiency has been aggravated in Indian sail due to increased cropping intensity, addition of S free fertilizers. Sulphur is now recognized as the fourth major nutrient after N, P and K. On an average, crops absorb sulphur as much as P and field scale deficiencies of S in the sails and plants are becoming increasingly important. the increase in green gram yield due to applied P and S has been reported by many wakers (shahi *et at*.2003; Kumar and Singh, 2009 , kumawat and kumawat ,2009; kumawat *et al*,2009; Kumar and singh (2011), khandelwal *et al*.(2013) and kanwar, *et al*. (2013).the increasing report of S deficiency and the fact that crops require P and S in the comparable amount suggest that S deserves greater attention then that it has received so far. A major portion soil of applied –P becomes fixed in the hence fertilizer utilization efficiency is reduced to a greater extent and only the crop utilizes a small fraction of phosphorus. The p and S Requirement differs with the variety grow and the soil type used. Such information for Chitrakoot region was lacking, hence the present research was taken up.

MATERIALS AND METHODS

The field experiment was conducted during

kharif season of 2013 at the rajola farm .M G C G V V , Chitrakoot , satna (MP) . The soil of the experimental field was sandy loam having soil pH 7.78, electrical conductivity 0.26 ds/m, Organic Carbon 0.33 g/kg, Available N, P_2O_5 and k_2O ,202, 16, and 246 kg/ha ,respectively. Available sulphur was 15.88 kg/ha. The rainfall received during the crop season was 80.204 mm. The treatment comprised four levels of phosphorus (0, 20, 30 and 40kg/ha) and three levels of foliar applied sulphur (0,1and 2% spray). The twelve treatment combination ware lewd out in a randomized block design (factorial) with three replications. the green gram variety Samrat was sowing on 21 july 2013 @ 15kg/ha in lines having row to row and plant to plant distance of 30 and 10 cm, respectively. The uniform application of 20 kg N and 30 kg K_2O kg/ha was applied as basal in all the treatments before sowing the crop. The phosphorus levels was applied as basal through DAP as per treatments and sulphur levels were applied twice through foliage at 20 and 40 DAS. The source of sulphur was in liquid having 55.16 % supplied by the Devi Dayal agro company, Gujarat. The crop was grown as per recommended package of practices. The crop was harvested on 25 September, 2013.

RESULTS AND DISCUSSION

Growth parameter

The data (Table 1) indicate that the application phosphorus to green gram up to 40 kg/ha brought about significantly higher plant height (69.94 cm), number of branches (37.00 /plant) number of trifoliate leaves (35.05 /plant) and number of root nodules (8.33 /plant) as compared to the preceding phosphorus levels. On the other hand, the significantly lowest growth parameter was recorded in case of control treatment having no phosphorus. Plant height was 61.27 cm, branches 27.61 per plant, trifoliate leaves 25.27/ plant and root nodules only 4.55 /plant. The maximum in create in all these growth parameter due to sufficient supply or availability of P for the actively growing plants because phosphorus played important role in root and shoot development and translocation of photosynthesis. Phosphorus being the constituent of nucleic acid, phytin and phospholipids; its application increased the plant height, branches and greener leaves per plant. Similar results have also been reported by singh et al, (1999), pandey *et al*. (2001), singh *et al*. (2003), Islam, M. and Ali, S. (2009), mahmood *et al*. (2010), and kanwar *et al*. (2013). Spraying of liquid sulphur @ 2 % at20 and 40 DAS growth stages enhanced all these plant growth parameters of green gram significantly as compared to the lower doses of foliar applied sulphur. The maximum plant height was up to 66.87 cm, branches 33.58 per plant, trifoliate leaves 31.25/ plant and root nodules 7.08 /plant. the maximum increase in all these growth parameters might be owing to the fact that applied sulphur enhanced the metabolic activities promoting chlorophyle formation and photosynthesis at hand/ and root development coupled with accelerated rhizobial activities landing to continuous supply of sulphur for production of food mateal at the adequate amount on the other. The present results corroborate with those of many warkers (pandey and singh (2001), himanshu *et al*. 2008).

Productivity Parameters

The data further reveal that the highest level of applied phosphorus (40 kg/ha) resulted in significantly higher grain yield (11.16 q/ha) as well as straw yield (16.84 q/ha) as compared to all the remaining lower phosphorus levels. The increase in these Productivity parameters

of green gram due to highest phosphorus level

might be owing to maximum increase growth parameters particularly leaves which are the increased photosynthetic surface area. This contributed to more absorption and metabolic translocations of photosynthetic towards the sink or grain (reproductive organs) and maintained better harmony between photosynthesis and translocation, and ultimately given rise to higher yields. Similar results low also been reported by singh *et al*. (2003) islam and ali (2009) mahmood *et al.* (2010).

Foliar application of sulphur up to 2 % at 20 to 40 DAS stages registered significant rise in grain and straw yield up to 10.42 and 15.94 q/ha, respectively as comported to the lower sulphur levels. the increase in the grain and straw yields due to foliar applied sulphur might be maximum increase in growth parameters which brought about increased partitioning of photosynthetic assimilates towards the sink or grain these results are in close conformity with those of Kaiser *et al.*(2010), and Mishra *et al.* (2011)

Table: 1. Growth and yield parameters of green gram as influenced by phosphorus and sulphur levels.

Levels (kg/ha)	Plant height (cm)	No. of leaf/plant	No. of leaf/plant	No. of leaf/plant	No. of branches / plant			No. of nodules /plant	Seed yield (q/ha)	Straw yield (q/ha)
	60DAS	20DAS	40DAS	60 DAS	20DAS	40DAS	60DAS	40DAS		
P-level										
0	61.27	10.00	23.05	25.27	3.22	7.00	27.61	4.55	8.98	13.95
20	64.66	12.77	27.61	28.22	4.44	8.27	32.11	5.88	9.86	15.34
30	66.50	14.66	31.38	31.88	4.83	9.50	34.38	7.00	10.22	15.87
40	69.94	16.44	34.72	35.05	6.72	12.72	37.00	8.33	11.16	16.84
CD(P=0.05)	0.77	0.43	0.51	0.40	0.48	0.60	0.61	0.67	0.23	0.33
S- level										
0 %	64.58	12.25	27.95	28.91	4.29	8.58	32.04	5.91	9.72	15.17
1%	65.33	13.58	29.37	30.16	4.70	9.29	32.70	6.33	10.03	15.4
2%	66.87	14.58	30.25	31.25	5.51	10.25	33.58	7.08	10.42	15.94
CD(P=0.05)	0.67	0.37	0.44	0.34	0.41	0.52	0.53	0.58	0.20	0.29
Interaction	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**

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ASSESSMENT OF BIO-CHEMICAL PARAMETERS OF WATER BODIES IN DIFFERENT SEASONS

Santosh Kumar Singh
Department of Chemistry
Sri J.N.P.G. College, Lucknow, (U.P.), India

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ABSTRACT

India is one among those developing countries which are facing severe problem of water pollution. Most of the industries discharge their effluent without proper treatment into nearby water bodies which detorites the quality of water. The safe portable water is absolutely essential for healthy life. The study area selected was different water bodies of Bakshi-ka-talab, (Uttar Pradesh, India). These are one of the important sources of drinking water supply for the Bakshi-ka-talab tehsil. It fulfills the drinking water needs of about 65 per cent of the city population. In addition to this it also serves the irrigation purpose of Bakshi-ka-talab tehsil and the surrounding areas. Attempts were made to study and analyze the Bio-chemical characteristics of the water.

Key Words **:** *Water, Soil, Chemical, Temperature, P^H meter.*

INTRODUCTION

Water Samples were collected and analysed (APHA1995, NEER1 1995) for the Bio-chemical parameters, temperature, pH, turbidity, total alkalinity, total hardness, calcium hardness as $CaCO_3$, magnesium hardness as $CaCO_3$, chlorides, iron, manganese and sulphate in three different seasons to ascertain the drinking water quality. The study reveals that the Bio-chemical parameters of water tested are well with in the WHO limits except for turbidity and it is a good quality for drinking irrigation and fish culture purposes.

Bakshi-ka-talab is a Tehsil of Lucknow District, It is one of the fastest small Industrial growing cities in the country. Water quality is an index of health and well being of a society. Industrialization, urbanization and modern agriculture practices have direct impact on the water resources. These factors influence the water resources quantitatively and qualitatively. The study area selected different water bodies of Bakshi-ka-talab tehsil of Lucknow.

MATERIALS AND METHODS

The study areas selected was different water bodies in Bakshi-ka-talab (U.P.). Water samples was analyzed for 11 parameters such as temperature, turbidity, pH, total alkalinity, chloride, total hardness, calcium hardness, magnesium hardness, iron, manganese and sulphate. Sampling and physicochemical investigation was carried out according to standard methods (APHA 1995; NEERI 1991).

The results were carefully studied and analyzed and compared with WHO Standards & BIS Standards with special reference to drinking suitability.

- Water temperature was recorded in the field using sensitive mercury thermometer.
- The pH of the samples was determined using digital pH meter.
- Turbidity was determined by Nephelo-turbidity meter.
- Total Hardness, calcium hardness and magnesium hardness was determined titrimetrically using EDTA method (APHA 1995).
- Total Alkalinity was determined by titrimetric method.
- Chlorides were determined by Mohr's argentometry method (APHA 1995).
- Iron, manganese and sulphate was determined by spectrophotometrically.

Table 1: Seasonal study of Bio-chemical parameters

S.No	Parameters	WHO Standards	BIS Standards	Rainy Season	Winter Season	Summer Season
1	Temperature	-	-	24.2	24.0	31.0
2	Turbidity	6	12	130	3.6	5.0
3	Ph	7-8.5	6.5-8.5	7.60	7.74	7.45
4	Total	210	610	128	110	124
5	Total	105	610	126	115	126
6	Ca hardness	75	200	57	69	87
7	Mg hardness	70	70	68	44	35
8	Chlorides	250	1000	15	15	16
9	Iron	1.0	.05	0.05	0.05	0.28
10	Manganese	0.5	0.5	0.22	0.17	0.46
11	Sulphate	250	400	7.0	4.0	5.0

RESULTS AND DISCUSSION

The observations and results of analysis of various Bio-chemical parameters of water of different water bodies of Bakshi-ka-talab was summarized in table 1 and they are also analyzed graphically. The data revealed that there were considerable variations in physico-chemical parameters from season to season. A comparison of the various Bio-chemical characteristics of the studied water samples has been made with the WHO (1984) and BIS (1998) standards. These parameters are discussed below:

Temperature

The maximum temperature of water was recorded in summer season which is 29,8°C. The variation in water temperature may be due to difference in timing of collection and the influence of season (Jayaraman et al. 2003). Temperature controls behavioral characteristics of organisms, solubility of gases and salts in water. No other factor has so much influence as temperature (Welch 1952).

Turbidity

The amount of suspended material in water can be measured by collecting the solids or assessing the relative light transmission of

the suspension. The increased opaqueness is caused by increased sediment which negatively affect many aquatic organisms. Both algal production and fish reproduction and feeding can become diminished and some organisms, like shell-fish (continual filter-feeders) can become choked by sediment and eventually die in heavily turbid waters. The maximum value of turbidity was observed in rainy season (128 NTU) which is much higher than the permissible limit as prescribed by WHO. Water may not be safe from hygienic point of view as under such conditions it becomes very difficult to maintain the minimum desirable limit of chlorine in the water.

Hydrogen Ion concentration pH :

pH is a unit that expresses the strength of a solution based on its acidic or basic properties. Aquatic organisms can only function in a particular range of pH, and become forced to relocate when the surrounding water changes. Pollution from burning fossil fuels increases the amounts of sulphur and nitrogen oxides introduced into the water. thereby increasing the overall acidity. WHO has recommended maximum permissible limit of pH from 6.4 to 9.5 (De, 2010). pH correction after the treatment of water can significantly reduce the corrosion and incrustation problems. The pH controls the chemical state of many nutrient including dissolved oxygen, phosphate, nitrate etc. (Goldmann and Home, 1983). It regulates most of the biological processes and biochemical reaction. (Verma et al., 2006). The pH was found in the range of 7.844 to 7.85 i.e. it has pH values within the desirable and suitable range.

Total alkalinity

The alkalinity of water is its capacity to neutralize acids. The maximum alkalinity was recorded as 126 ppm in rainy season. BIS has set a desirable level of alkalinity in drinking water to be 200 ppm where as its value has been prescribed to be 600 ppm in the absence of alternative source. The alkalinity fluctuated in accordance with the fluctuation in the pollution load.

Total hardness

The maximum total hardness was recorded as 125 ppm in rainy season and the minimum value was recorded as 113 ppm in winter season. The hardness of water is not a pollution parameter but indicates water quality. Hardness Is an important parameter in decreasing the toxic effects of poisonous elements. It is within desirable limit. BIS has prescribed desirable limit of total hardness 300 mg/I and permissible limit in the absence of alternate source 600 mg/1 (De, 2010).

Calcium hardness

Its value was found in the range of 57 mg/I to 87 mg/I & it is with in the permissible limit as prescribed by WHO.

Magnesium hardness

Its value was found in the range of 35 to 68 mg/1. Its value is with in the permissible limit as prescribed by WHO.

Chloride

Chloride occurs in all natural waters in widely varying concentrations. The chloride contents normally increases as the mineral contents increases (Dubey 2003). In the present study the chloride concentrations were found in the range of 09-10 ppm.

Iron

Its value was found in the range of 0.5 mg/1 to 0.28mg'L It is with in the permissible limit as prescribed by WHO.

Manganese

Manganese is essential element which

does not occur as a metal naturally but it is found in the form of salts and minerals. Its deficiency cause bones abnormalities and reproductive dysfunction. The maximum concentration of manganese was recorded as 0.46 ppm in summer season and the minimum value was recorded as 0.22 ppm in rainy season, which is well with in the permissible limits as prescribed by WHO.

Sulphate

It usually occurs in natural waters. The presence of sodium sulphate and magnesium sulphate in drinking water beyond the permissible limits may cause cathartic action. The value of sulphate was found in the range of 5.0 mg/1 to 7.0 mg/1. Its value is much lower than the permissible limit as prescribed by WHO.

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EFFECT OF SULPHUR AND ZINC ON GROWTH AND YIELD OF MUSTARD (*BRASSICA JUNCEA L*), UNDER RAINFED CONDITION

Uma Shankar Mishra, Rajesh Dhakar and Ravi Shankar Mishra
Department of N.R.M & Faculty of Agriculture
M.G.C.G.V.V Chitrakot Satna (M.P.), India

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ABSTRACT

The present experiment was conducted during the *Rabi* season of 2014-15 at field experimentation center of Rajoula, faculty of agriculture M.G.C.G.V Chitrakoot M.P. The experiment was carried out with "Pusa Mahak" a variety of mustard grown in randomized block design with three replications and different treatment combination. The combination are 0, 15, 20, 25 kg/ha sulphur and 0, 5, 7.5,10 kg/ha zinc respectively along with recommended dose of NPK level on productivity, nutrient content and uptake by mustard. The best treatment combination was found in 25 kg/ha & 5 kg Zn/ha along with NPK under rainfed condition of chitrakoot for obtaining higher seed yield of mustard crop.

Key word: *Mustard, Sulphur, Zinc.*

INTRODUCTION

Mustard (*Brassica juncea L.)* is an important oil seed crop In India; Oilseed crops are cultivated on 26.77 million ha, with productivity of 1087 kg ha-1 for the triennium ending 2012/13. However, this production is not enough to meet the ever-growing vegetable oil demand and so the country is a net importer at a huge cost to the exchequer. The average productivity of oilseeds in India is far below that of developed countries (2.5–3.0 t ha-1) and world average (1.9 t ha-1). Low productivity of oilseeds is mainly due to their cultivation under rainfed conditions and on marginal soils. Apart from water shortage, the productivity in rainfed systems of semi-arid India is low due to poor fertility status of the soils (Chander G *et al.* 2010).The fertilizer requirements of oilseed crops are actually applied leading to continuous mining of nutrients from the soil by oilseeds Thus there is urgent need for stepping up use of deficient major, secondary and micronutrients (Hegde and Sudhakara Babu 2009).In recent years S-deficiency has become an essential mineral element for optimal productivity. An increasing problem for agriculture resulting in decreased insufficient supply of mineral elements may lead to limit in crop quality

Parameters and yields in some agricultural soils particularly in considerably in their S requirements Insufficient Micronutrients like Zinc (B) most *Brassicaceae*, has greater S requirements than other are often common. Hence, these elements can be supplied large crop species such as wheat or maize. For example, as fertilizers in both intensive and extensive agricultural the production of 1 ton of rape seeds requires 16 kg of S systems.

Sulphur Deficiency in Mustard causes yellowing of interregnal areas. Later, the tip and margins of the chlorotic leaves turn necrotic; young leaves which emerge after 30 days fail to expand and remain much smaller than healthy plants. Sulphur deficient plants show marked retardation in height, thickness of stem and size of leaves (ICAR Progress Report (1998). Agricultural soils with low zinc (Zn) availability are widespread worldwide. There are estimates that more than 30% of agricultural soils globally are low in available Zn leading to deficiency in crops cultivated on these soils Mishra and S.K. (2001). Therefore Zn malnutrition has become a major health concern among the resource poor people Mishra *et.al*.(2002). In India, Zn is one of the multi-nutrient deficiencies that are causing poor crop yields. Zinc deficiency in Indian soils is expected to increase from 42% in 1970 to 63% by 2025 due to continuous depletion of soil fertility A direct yield loss of US$ 1.5 billion is estimated due to low crop yields besides huge loss due to disease concerns arising out of Zn malnutrition in the count country (Singh 2010). Slow pace in productivity growth in oilseeds has thus been often linked to imbalanced and inadequate application of major, secondary and micronutrients. Among the micronutrients, Zn has gained macro importance to meet soil fertility needs to enhance productivity. For an optimum plant growth and seed yield, adequate supply of Zn is essential. Therefore, this paper discusses about widespread Zn deficiency in major oilseed growing states, effects of Zn use and soil– crop–zinc fertilization management for increasing productivity of oilseed crops.

Zinc-deficient plants are stunted and produce small, thin grains. Adverse soil conditions, such as increasing occurrence of drought spells or salinity aggravate Zn deficiency problem in crop plants (Bagci *et al*. 2007). These A biotic stresses/adverse soil conditions lead to impeded growth of plants and slow root activity, resulting in an inhibited spatial availability of Zn. The sufficient research information's on Sulphur and Zinc fertilization of Mustard is not available for Chitrakoot area of Satna district which grows Mustard on sizeable area of about 7.2 thousand hectares.

MATERIALS AND METHODS

The present experiment was conducted during the *Rabi* season of 2014-15 with Randomized block design along with three replication of mustard crop variety Pusa Mehak at *Rajula Farm of the Faculty of Agricultural Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot – Satna (Madhya Pradesh)* located from 24 31' N latitude and 81 15' E latitude. Soil samples were collected separately from each plot of the experimental field to a depth of 0-15 cm prior to sowing of mustard crop The Samples Were Analyzed For its physico-chemical properties and the mean values obtained are given. The soil of experimental site was sandy loam in texture, low in organic carbon, nitrogen and phosphorus and medium in available potassium.

RESULTS AND DISCUSSIONS

Growth parameters

Plant height a measure of growth was recorded periodically at an interval of 30 days starting from days after sowing up to harvest stage. The mean data on plant height in Table-1 indicates that it was enhanced by multi-fold with the advancement of plant growth till 90 DAS; thereafter such an increase was slow up to the harvest stage. The plant height was found to be influenced significantly due to different levels of Sulphur and Zinc at all the growth stages. In general, it was observed that the significant increase in yield attributes resulted due to

higher levels of sulphur which applied with recommended dose of nitrogen, phosphorus and potassium. It due to the vigorous vegetative growth of the crop under the higher level of fertility, which resulted in adequate supply of photosynthetic in the formation of branches, siliqua and development of seed. Babhulkar PS (2000)

Plant height was recorded in the range of 24.67 to 27.06, 131.91 to 138.91, and 144.25 to 149.33 cm under different level of Zinc at 30, 60, 90 DAS and harvest stage respectively.

It is inferred from Table 1, that application 10 kg/ha of Zinc resulted significantly higher tiller plant as compared to control at 90 DAS stage, whereas 30 DAS different levels of Zinc show any significant effect on plant height. Our results confirm the finding of Kumar *et al*. (2001), Singh (2005) and Singh and Meena (2004) Kumar *et al*. (2006) and Aye K. S. (2011)

also observed that the application of sulphur in mustard @ 20 and 40 kg ha^{-1} significantly increased seed yield and its attributes viz., siliquae / plant, seed/ siliqua and test weight .The interaction effect due to sulphur and Zinc on plant height was found statistically significant at all the observation stages.

NUMBER OF LEAVES/ PLANT

The number of leaves per plant was observed at 30, and 60 DAS and found significantly influenced due to different treatments are presented in table-1 and The number of leaves / plant was found to be significantly due to treatments of different levels of sulphur and Zinc.

EFFECT OF SULPHUR ON NUMBER OF LEAVES / PLANT

Number of leaves / plant ranged from 4.41 to 9.25, 15.24 to 24.85 and 17.05 to 28.21 under different level of Sulphur at 30, 60 and 90 DAS respectively.

At 30 DAS, maximum number of leaves / plant observed with the application of sulphur 25 kgha-1 (S3) which was significantly higher to 0 and 15 kgha-1 (S0 & S1) and statistically at par with 20 kgha-1 levels (S2).

At 90 DAS, maximum number of leaves / plant observed with the application of sulphur 25 kgha-1 (S3) which was significantly higher over rest all the other levels of sulphur.

EFFECT OF ZINC ON NUMBER OF LEAVES / PLANT

Number of leaves / plant ranged from 5.67 to 7.15, 17.09 to 19.33 and 19.35 to 23.78 under different level of Zinc at 30, 60 and 90 DAS respectively.

It is inferred from Table 1, at 90 DAS, application of 7.5 Zinc $kgha^{-1}$ resulted significantly higher number of leaves / plant as compared to control and treatments, whereas 30 DAS 7.5 $kgha^{-1}$ of Zinc produced maximum number of leaves / plant which was significantly higher over control but statistically at par with 7.5 $kgha^{-1}$ treatment.

Root length-

Root length/plant observed in the range of 4.39 to 6.45, 10.30 to 16.11, and 13.05 to 19.95 cm. under different level of sulphur at 30, 60, and 90 DAS stage respectively.

It is clear from Table 1, that the increasing level of sulphur up to 25 kg ha^{-1} increased the root length / plant (cm.) significantly at 30, 60, and 90 DAS stage. Maximum root length / plant (cm.) was observed with the application of sulphur 25 $kgha^{-1}$ (S_3) which was significantly higher to 0, 15 and 20 $kgha^{-1}$ (S_0, S_1 & S_2).

EFFECT OF ZINC ON ROOT LENGTH /PLANT (CM.)

Root length / plant (cm.) ranged from 4.75 to 17.73 under different level of Zinc at different observation stage of present study.

It is inferred from Table1, that at 90 DAS and harvest stage, application of 5 kgha-1 Zinc resulted significantly higher root length / plant (cm.) as compared to control and one spray treatments, whereas 60 DAS 5 kgha-1 Zinc produced maximum root length / plant (cm.) which was significantly higher over control but statistically at par with 2.5 kgha-1 zinc treatment.

At 30 DAS, root length / plant (cm.) show any significant difference in different levels of Zinc. The interaction effect due to sulphur and Zinc on root length / plant (cm.) was found statistically significant at all the observation stages except 90 days stage where interaction was found significant.

YIELD ATTRIBUTING CHARACTERS:-

Number of siliqua per plant

Effect of siliqua on number of siliqua/plant

Number of siliqua/plant observed in the range of 110.50 to 138.66 under different level of sulphur at harvest stage. It is clear from Table 1, that the increasing level of sulphur up to 25 kg ha^{-1} increased the number of siliqua/plant significantly over control. Maximum number of siliqua/plant was observed with application of 25 kg Sha^{-1} (S_3) which was significantly higher to 0 and 15 kg Sha^{-1} but statistically at par with 20 kg S ha^{-1}.

EFFECT OF ZINC ON NUMBER OF SILIQUAE/PLANT

Number of siliquae/plant observed in the range of 115.08 to 129.83 under different level of Zinc at harvest stage.

It is inferred from Table-1, that application of 5 $kgha^{-1}$ Zinc resulted significantly higher number of siliqua/plant as compared to control. The interaction effect due to sulphur and Zinc on number of siliqua / plant was found statistically significant and data are presented in table.

Number of siliqua / plant noted 103.33 to 146.00 under different treatments combination of sulphur and Zinc. Maximum number of siliqua / plant (146.00) was observed with S_3Zn_1 which was significantly higher over rest all the treatment combination. Whereas S_3Zn_2 and S_3Zn_3 did not show significant difference from each other. Whereas minimum number of siliqua/plant was noted with S_0Zn_0 treatment combination.

Number of seeds/siliqua

Effect of sulphur on number of seeds/siliqua

Number of seeds per siliqua noted in the range of 7.00 to 15.25 under different level of sulphur It is evident from Table-1, that the increasing level of sulphur up to 20 kg ha-1 increased the number of seeds per siliqua significantly. Maximum number of seeds per siliqua (15.25) was observed with application of 25 kg S ha-1 (S3) which was significantly higher to 0 and 15 kg Sha-1 but statistically at par with 20 kg S ha-

1. Effect of Zinc on number of seeds per siliqua

Number of seeds per siliqua observed in the range of 7.91 to 12.83 under different level of Zinc at harvest stage It is inferred from Table 4.4, that application of 5$kgha^{-1}$ Zinc resulted significantly higher seed/siliqua as compared to control and one spray treatments. The interaction effect due to sulphur and Zinc on number of seeds per siliqua as found statistically significant and data are presented in table 1

Seed weight (1000seed)

A significant increase was noted in 1000 seed weight under different levels of sulphur as compared to the control. It is observed in the range of 3.00-5.50 g under different treatments.

Effect of sulphur on 1000seed weight:-

It is evident from Table-1, that the increasing level of sulphur up to 25 kg ha^{-1} increased the 1000 seeds weight significantly. Maximum test weight (5.50 g) was observed with the application of 25 kg S ha^{-1} (S_3) which was significantly higher to 0, 15, and 20 kg $Sha^{-1.}$

Effect of Zinc on 1000 seed weight

Test weight of seeds observed in the range of 3.09 to 4.80 g under different level of Zinc at harvest stage.

It is inferred from Table-1, that application of 5kgha^{-1} resulted significantly higher test weight of seeds as compared to control but statistically at par with no zinc. The interaction effect due to sulphur and Zinc on test weight of seeds was found statistically significant and data are presented in table-1

Test weight of seeds noted 1.93 to 6.36 g under different treatments combination of sulphur and Zinc. Maximum test weight of seeds (6.36 g) was observed with S_3Zn_1 which was significantly higher over rest all the treatment combination except S_3Zn_2, S_3Zn_3 and S_2Zn_1 which show significant difference from each other. Whereas minimum test weight was noted with S_0Zn_0 treatment combination.

(i) Seed yield (kg/ha):

Table 1, indicated that there was a significant response in seed yield due to different levels of sulphur and Zinc as compared to respective control.

Seed yield varied from 14.10 -16.95 kg/ha under different levels of sulphur and the magnitude of increase in yield due to various levels was14.21- 40.40 % over control.

It is evident from Table-1, that the increasing level of sulphur increase the seed yield significantly up to 25 kg ha^{-1}. Maximum yield (16.95 q/ha) was observed with the application of 25 kg S ha^{-1} (S_3) which was 40.40, 22.93 and 8.79 percent significantly higher to 0, 15 and 20 kg Sha^{-1} treatments respectively.

(ii) Stover yield (kg/ha):

Table -1 indicated that there was a significant response in Stover yield due to different levels of sulphur and Zinc as compared to respective control.

Effect of sulphur on Stover yield

It is evident from that the increasing level of sulphur increases the Stover yield significantly up to 25 kg ha^{-1}. Stover yield varied from 6.92 to 15.45 q/ha under different levels of sulphur. Maximum yield (15.45 q/ha) was observed with the application of 25 kg S ha^{-1} (S_3) which was significantly higher to 0 and 15 kg S ha^{-1} but statistically at par with 20 kg S ha^{-1} treatments respectively.

Effect of zinc on Stover yield

Stover yield observed in the range of 8.78 to 12.96 q/ha. Under different level of zinc, it is inferred from table-1 that the maximum yield (112.969/ha) has with 5kg/ha. Of zinc while was significantly higher over control.

Growth and yield attributes characters:

The application of different levels of sulphur and levels of Zinc with recommended dose of phosphorus and potassium, increased almost all growth and yield attributing characters significantly, however, the trend of increase was towards positive direction.

Interaction Effect:-

The interaction effect due to sulphur and zinc on Stover yield was found statistically non significant present in table-1

The results reported in foregoing pages revealed that the maximum value of growth characters (Plant height, number of leaves & root length/ plant) was observed with application of 25 kg S ha^{-1} (S_3) and 5 kg ha^{-1} Zinc.

It is clear from the results that the increasing level of sulphur up to 25 kg ha^{-1} increased the number of branches / plant significantly at 30, 60 and 90 DAS stage. Maximum number of branches / plant was observed with the application of sulphur 60 kg ha^{-1} (S_3) which was significantly higher to 0, 15 and 20 kg ha^{-1} (S_0, S_1 &S_2).

Application of 25 kg S/ha showed the best results in different yield component, the effect of 20 kg S/ha was found at par. On the other hand, levels of Zinc increased all the yield component of mustard over control. Maximum number of siliqua/plant, seeds/siliqua and 1000 seed weight was produced by 25 kg S ha^{-1} (S_3) which was significantly higher over 0 and 15 kg Sha^{-1} but statistically at par with 20 kg S ha^{-1}.The probable reason may be that adequate supply of all the nutrients, particularly sulphur which resulted in greater accumulation of carbohydrates, amino acids and their translocation to the productive organs, which, internal improved all the growth and yield attributing characters. Increases in siliqua per plant and seed per siliqua, were higher under higher rate of sulphur because of the higher translocation of food material for the formulation of seeds. Dubey *et al*.(2013).

CONCLUSION

On the basis of foregoing summary thus it may be concluded that the combination of 25 kg S/ha and 5kg Zinc/ha along with recommended doses of N, P and K under rainfed condition should be applied in mustard crop for obtaining higher seed yield with highest net return and benefit cost ratio.

Table-1- Growth, yield and yield attributes of mustard as influenced by sulphur and zinc levels.

Levels (kg/ha)	Plant height (cm)	No. of leaf/plant	No. of leaf/plant	No. of leaf/plant	Root length (cm)	Pod /plant	Seeds / pod	1000seed weight (g)	Seed yield (q/ha)	Straw yield (q/ha)
S-level	90DAS	30DAS	60DAS	90 DAS	90DAS					
0	138.66	14.41	15.24	17.05	13.05	110.50	7.00	3.00	14.10	6.92
15	145.83	5.75	17.20	20.50	15.05	119.91	7.08	3.40	15.65	9.93
20	150.50	6.81	18.46	25.06	18.05	130.83	12.16	4.55	16.96	13.35
25	157.16	9.25	29.85	28.21	19.95	138.66	15.25	5.50	16.95	15.45
CD(P=0.05)	0.72	0.77	0.48	0.38	0.28	1.05	0.44	0.05	0.28	0.35
Zn- level										
0	144.25	5.67	17.09	19.35	14.90	115.08	7.91	3.09	14.00	8.78
5	149.25	6.27	20.10	24.43	17.73	129.83	12.83	4.80	17.91	12.96
7.5	149.25	7.15	19.33	23.78	17.00	128.41	11.75	4.49	16.64	12.18
10	149.33	7.12	19.23	23.26	16.48	126.58	11.00	4.07	15.61	11.74
CD(P=0.05)	0.72	0.77	0.48	0.38	0.28	0.05	0.44	0.15	0.08	0.35
Interaction	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**	**Sign.**

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MEDIA POLICY AND SUSTAINABLE DEVELOPMENT IN INDIA:ISSUES & CONCERN

Sujeet Srivastava
Centre for Development Studies
Institute of Inter-Disciplinary Studies
University of Allahabad, Allahabad-211002 (U.P.) India

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ABSTRACT

This paper examines the role of Media Policy in Sustainable Development with the special reference to India. It also deals that how media policies link with agendas for sustainable development. Thisstudyis based on a review of international andnational research literatures. Media plays a vital and important role in the public awareness for the environment sustainability. It also ensures people participation to protect and preserve their natural resources and environment. Sustainable Development can be attained by protecting our Earth in a judicious use of natural resources and environment. Our country is known as the fastest developing economy and nation among the whole world. That's why to attained the concept of sustainable development that ensure the sustainability of present and future generations, our government media policies must include the idea of sustainability in the reporting and drafting the news in a print media as-well-as in the electronic media. The government agencies, non-government agencies and the people, all depend on Mass Media not only for the news and information, but also in setting agenda for the development activities at the personal, local, national and global level. In this regard media plays a pivotal role in creating awareness and bringing the positive behavioral change among people to attain the concept of sustainable development in India.

Keywords: *Media Policy, Sustainable Development, Mass Media and Environment Sustainability.*

INTRODUCTION

The target year for the Millennium Development Goals (MDGs), 2015 has come but it is clear that current development efforts have not delivered the results the world's poor need and the global community promised in the Millennium Declaration signed by the leaders of 189 countries in September 2000. At present especially in our country, the people are striving for their basic needs as potable water, sanitation, health, education, environment as-well-as for the employment. Atr present our natural resources depleting and polluting at the faster and alarming rate. The world's poor community

is solely depending for their livelihood on the environment.

The concept of Sustainable development has been defined in many ways, but the most frequently quoted definition is from Our Common Future, that's known as the Brundtland's Report. It states that "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (BrundtlandCommission: 1987).

The four elements that affect the concept of Sustainable Development are Planet, People, Pollution and Poverty. In the course of sustainable development Planet must be conserve, People must be Healthy and Happier, Pollution must me reduced and Poverty must be eliminated at a lager extends. These four "P" factors are existing in the SEE that is Society, Economy and Environment.Any type of development cannot be takes place without the better prospects of Society, Economy and Environment.

Our environment is the greatest gift to mankind. This word environment is to many synonymous with air, land, water, plants and animals, while the scientists see the environment as consisting of both living organisms and their physical surroundings such as water, soil and air (Akiyode, 2004).

The environment is the most important heritage and necessity of mankind responsible for the sustenance of life and life forms on our planet. During the last 50 years, our country has undergone dramatic changes in terms of pollution, population, poverty and society. Our environmental problems are largely due to the exponential population growth and massive industrialization and urbanization thatare putting severe and extra stress on the earth's natural resources.

Mass media are extremelyessential for the Sustainable development in the Indian Society. Mass mediacreates empathetic spirit, widens people's horizon and connect the people under the same roof of any idea or message. That is why Bellurkar*et al* (2000) stated that the mass media should be put to service for national development. Among the different mass media radio and television are considered as powerful, most accessible media, as an institutionalized source of information for creating awareness about the innovation existent with additional information. They are used as powerful educational, entertainment and public awareness tools.

MEDIA POLICY AND SUSTAINABLE DEVELOPMENT IN INDIA:

In the advanced western countries, the Communication Revolution had not preceded but followed the industrial Revolution.(P.C. joshi 2004, pg xxiv) .Western societies had become advanced industrial and urban societies when the communication revolution happened. This revolution was symbolized by the Radio and Television and other new ways of "passing ideas, information, attitudes, images from person to person" (Raymond's Williams 1966).

The importance of the role of communication for national development was underscored in India even prior to her independence. The Indian National Congress while formulating policies for National Development for Independent India set up a Sub-committee on Communication under the National Planning Committee to offer recommendations fordevelopment of communication for independent India. After independence of the country in 1947, the new Indian government announced a development oriented agenda of governance dedicated to a combined way of the economic, educational, environment and health

conditions of the people. With the target of Development Communication, the new government adopted the recommendations of the erstwhile National Planning Committee as the mainstay of its communication policies. "The issue of using modern communication acquired high priority as a

developmental resource during the Nehru era when the planners explored the prospects of using *radio* as a development agent, that is, for information and enlightening the people in the countryside and towns on developmental issue" (Ibid)

Nehru was hesitant of introducing television in India as he was apprehensive that it will be monopolized by the middle class rather than be of use for the development of the masses. Pt. Nehru believed that a poor country like India could ill afford the *extravagance* of television. But post Nehruvian era, the thrust began to change, visionary scientists like VikramSarabhai argued that India needs all possible technological know-how to educate all round development. Sarabhai famously said: "Our national goals involve leap-frogging from a state ofeconomic backwardness and social disabilities attempting to achieve in a few decades a change which was incidentally taken centuries in other countries and in other lands. This involvesinnovation at all levels."(Vikram Sarabhai and Kamala Chaudhury, 1974)

Sarabhai argued on this premise that *television* be given special priority for accelerating national development. He believed that technology can help set a national agenda for"implementing schemes of economic and social development. It is of particular significancefor population living in isolated rural countries" (Ibid)

Indira Gandhi, the then Prime Minister of India was supportive of Sarabhai's ideas and itculminated in the launching of the momentous Satellite Instructional Television Experiment in1975-76 from the Space Application Centre located at Ahmedabad. It started beaming development oriented programmes to 2400 Indian Villages, the software were designed according to the socio cultural specificities of the areas concerned. It was a path breakingexperiment in the field of development communication not only in India but also for the wholeworld. Till then Radio and television was considered an instrument of entertainment for the elite.And this was a new effort in utilizing both the media for Development Support Communication.

These experiments were revolutionary in character as "market forces would never have taken TVsets to many of these villages and most certainly not to the houses of the poor and themarginalised--- the most information needy. This means was high technology (a direct broadcastsatellite and a direct reception system) and the configuration was need-based." (kirankarnik, 1987, pg 88) Accepting thatthe western world used the new technology and innovation to spread consumer culture, Nehruurged upon the scientists and the technologists to bend the same technology to achieve theGandhian task of"ending of poverty and ignorance and disease and inequality of opportunity."

During the days of Indira Gandhi the infrastructure for television communication received amajor boost. Between the years 1984-85 over 120 television transmitters were installed in India.But as is a typical Indian trait, the SITE experiment in the Kheda district died a silentdeath with Sarabhai. "The Kheda Project itself was wound up under tremendous pressure of thenew rural middle class which was carried away by the glitter and glamour of the new

televisionsoftware…" (Ibid P.C. Joshi 2004, pg xxviii)

With the impending globalization of the media the question of ownership pattern and issues became a very important topic of deliberation. In fact this issue was much thought about even during the days of Nehru. Nehru showed an unambiguous indication of predilection towards the BBC style of autonomy. On a speech delivered on "freedom of information" on March 5, 1962 Nehru said "The mass media which are very useful have an element of danger in them in that they may be distorted for private aim. The rich group (inside) or the rich nation (outside) can flood the country and the world through the mass media with its own view of things which may or may not be correct view." These words had turned out to be ominously true in the present world. Because after India adopted neo-liberal economic policies in early 1990s, the communication policies underwent a drastic change.

The state-controlled media agencies, viz., All India Radio and Doordarshan (national television network), till then dedicated more to the objective of public welfare, were asked to generate their own revenue. Both Radio and Television were laid open to private players. TRP and RAM started dictating the terms of popularity and hence advertisement revenue. Television was the major victim of this market oriented media policy. Slowly, the villages started disappearing from the visual media. So did the issues inflicting the marginalized rural population. Whatever rural flavor was left in Radio was the run of the mill, very stale and unimaginative. However, it is not that urban India was realistically represented; it was more of a conjecture with no specific geographical root.On the other hand Sustainable Development in India, need a well aware and well informed society that is enable with other type technological development.

India is among the top 12 mega centers of the world in terms of its genetic diversity. It has a wide range of geo-climatic conditions and a rich and varied flora and fauna, as well as a long standing tradition of environmental sensibility and concern that goes to the very roots of its millennia-old culture. Harmony with nature has been an integral part of the ethos of Indian society. The Prime Minister of India, Mrs. Indira Gandhi, was the only foreign Head of State or Government to participate in the United Nations Conference on Human Environment held in Stockholm in June 1972, at a time when international concern over environmental issues was yet to fully crystallize. At that session she emphasized that the environmental concerns cannot be viewed in isolation from developmental imperatives of developing countries.

India is a party to numerous multilateral environmental conventions which contribute to the protection of the environment and to sustainable development. These include the UN Framework Convention on Climate Change, the Convention on Biological Diversity, the Vienna Convention on the Protection of the Ozone Layer, the Montreal Protocol on Substances that Deplete the Ozone Layer, the Ramsar Convention on Wetlands of International importance, the Basel Convention on the Transboundary Movement of Hazardous Wastes, the Convention on Combating Desertification, and the Convention on the International Trade in Endangered Species of Wild Flora and Fauna. India is also an active member of the Commission on Sustainable Development that was set up after the Rio Conference to monitor the implementation of Agenda 21.

As the above discussion it is clear now

that the Media is an important tool in the way of Sustainable Development of our society. It also plays an important and pivot role to run our society, economy and environment. That why Media Policy of India is a concrete way among the people of our country to connect, create and contribute in the way of Sustainable Development for the individuals, society and the state itself.

IMPACT OF MASS MEDIA ON THE SUSTAINABLE DEVELOPMET OF INDIAN SOCIETY:

Globally, it's been reported, “little of the growth of the past 20 years has improved the quality of human life. Most of the benefits have gone to the very wealthy and the remainder has been offset by the costs of resource depletion, social stress, and environmental health and other problems caused by growth.” “Sustainable development conventional vs. emerging alternative wisdom” by David C. Korten (internet document) Further, in the process of growth, nations have typically under-invested in human capital and over- exploited natural capital.

The raise in living standards of the mass of the population occurred in developed world in the past 100 years while this has been happening in most developing world and especially in the case of India is in the last half of the century.But, at the same time, increased development, rising living standards, and increased consumption and production result in increased pressure on the environment, threatening the long-term sustainability of the earth's life-support systems.

So despite recognition of the problem and a well-planned vision for the year 2050, including government policiesdirected at environmental preservation besides economic andsocial development, there is a danger that when thebehavior of people does not change towards a more sustainable way of living.

There are obvious links between poverty, environmental degradation, and economic development. The precursor for all later developments was the United Nations Conference on the Human Environment

(UNCHE, United Nations 1972) in Stockholm in 1972, wherethe then our Prime Minister Indira Gandhi already saidthat “the environment cannot be improved in conditions ofpoverty”. It is often thought that economic development alonewill alleviate poverty through increasing income levels of thepopulation. This unfortunately passes by the fact that theresulting environmental degradation can also lead toincreased poverty.

It was this realization of the links between environment,economic development, and poverty which resulted in thecoining of the term 'sustainable development' by the UnitedNation's Brundtland Commission in 1987. It is defined as development “meeting the needs of the present without compromising the ability of future generations tomeet their own needs” (Brundtland 1987), with as basic

pillars economic development, social development, andenvironmental protection at the local, national, regional, andglobal levels (United Nations 2002). In other words, sustainable development strives to achieve economicdevelopment that can be maintained well into the future andfor all human beings. The Brundtland Report describes thecommon challenges facing the earth, namely: growingpopulations; securing food security; threats to andconservation of species and ecosystems; energy use anddepletion of energy sources; industrial development; increasing urbanization; and the relationship between povertyand environmental degradation and

inequality between the developed and developing world.

The goal of sustainable development has been generallydescribed as to achieve a sustainable society. This means asociety in which economy and population size are managed insuch a way that they do not do irreparable harm to theenvironment by overloading the planet's ability to absorbwaste and pollution, replenish its resources, and sustainhuman and other forms of life over a specified period of time.In a sustainable society the needs of people are satisfiedwithout depleting natural resources and thereby reducing theprospects of current and future generations of humans andother species of Plants and Animals. The objectives of sustainable development oftenare mentioned as: reviving growth; changing the quality ofgrowth; meeting essential needs for jobs, food, energy, water,and sanitation; ensuring a sustainable level of population;conserving and enhancing the resource base; reorienting

technology and managing risk; and merging environment andeconomics in decision-making.

Since 1987, the term has seen a mass distribution andpopularization to the extent that now practically every nationhas adopted sustainable development as one of the officialpolicy objectives. In 1992, the United Nations Conference onthe Environment and Development (UNCED) in Rio deJaneiro, Brazil resulted in the adoption or signing by morethan 178 nations of Agenda 21 (a 300-page plan for achieving

sustainable development in the 21st century) and the Rio Declaration on Environment and Development (UNCED1992). Principle 8 and 10 of this declaration state that "toachieve sustainable development and a higher quality of lifefor all people, States should reduce and eliminateun sustainable patterns of production and consumption and promote appropriate demographic policies" (Principle 8); andthere has to be "participation of all concerned citizens…eachindividual shall have appropriate access to information concerning the environment...and the opportunity toparticipate in decision-making processes. States shallfacilitate and encourage public awareness and participationby making information widely available.."(Principle 10).

As will be shown later, these two principles are importantsince they provide a direct link between sustainabledevelopment, media, and democracy.In 2002 the Rio Conference was followed up by the World Summit on Sustainable Development in Johannesburg, SouthAfrica, where states recommitted themselves to the RioDeclaration Principles; more concrete measures and targetsfor better implementation of the Agenda 21 and theMillennium Development Goals were discussed (United

Nations 2002). Article 11 of the Report states: "We recognize that poverty eradication, changing consumption andproduction patterns and protecting and managing the naturalresource base for economic and social development areoverarching objectives of and essential requirements forsustainable development." Thus from economic developmentalone as the solution to problems of poverty and environmental degradation, we have now reached a general consensus that arriving at a sustainable society includes achieving both economic, social, as well as environmental sustainability. Therefore, we can say that without the active, effective and judies role of media in the society, we could not

assume the sustainable development in the society as-well-as in the Nation.

MATERIALS AND METHODS

The present study is based on the set of secondary source of data that being driven from the sort of studies that have been carried out at the National and International level. In this paper, the present analysis is focused in the area of Sustainable Development in India with the help of ICT (Information Communication Technology) at mass level. This study also reveals existing policy set-up in India. The mass media policy is an important tool for the sustainable development among the developing world.

RESULTS AND DISCUSSION

The media revolution has opened up new possibilities and tool of economic, environmental and social transformations from which developing country like India can be benefited at a larger extent. Unlike other technological innovations, Media especially Mass Media have almost immediate, deep and wider impact among the India Society. Media contributes at a larger extent in the form of economic growth and the integration of different society in this globalized era. In the word of *Lester R. Brown* "*The world today is economically richer and environmentally poorer than ever," and the world's poorer population are directly depends on the environment for their livelihood.*

It has been nearly a decade since the terms "sustainable development" and "sustainability" "rose to the prominence of mantra—or a shibboleth"(Daly 1996) following the 1987 publication of the UN-sponsored World Commission on Environment and Development (WCED) report, OurCommon Future. Despite its acclaimed vagueness and ambiguity, the WCED definition of sustainable development has been highly instrumental in developing a "global view" with respect to our planet's future. Besides the sweeping effect of environmental degradation, ecological factors have been one of the major driving forces behind every social transformation recorded in history, including the agricultural and the industrial transformations.

Media have a key role to play in addressing the ecological issues and crisis facing our country and elsewhere on this planet. Mass Media as a means of information dissemination for environmental education among the wide range of Indian society. It is the media and media policy adopted by our government that enables the general public to know their fundamental right in terms of the environment. Our environment provides us with the life support mechanism, and if we refuse to protect it, our future and that of the unborn generation may be doomed.

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EFFECT OF PHOSPHORUS AND ZINC FERTILIZER ON MUSTARD [*BRASSICA. JUNCEA*(L)] IN ENTISOL OF KAYMOR PLATEAU

P. Sirothia and V. C. Chaturvedi
Faculty of Agriculture, M.G.C.G.V. Chitrakoot, Satna, (M.P.), India

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ABSTRACT

A field experiment was conducted at rajaula Instructional farm at M.G.C.G.V. Chitrakoot, Satna. M.P. during rabi season to study the effect of varied doses of phosphorus (0, 20, 40 and 60 kg ha^{-1}) along with doses of zinc in form of EDTA (0,5 and 10 kg ha^{-1}) on Varuna cultivars of mustard with 3 replications arranged in 2 factorial randornized block design, Following all agronomical practices. The seeds of Varuna cultivar were sown in furrows with proper plankings. The observed data shifted in table and analysed which revealed that every successive dose of phosphorus and zinc increased the growth and yield significantly but doses of 40 and 60 kg of phosphorus were found at par in growth as well as in grain yield while stovers showed increasing pattern in its production in response to doses of phosphorus and zinc. Maximum enhancement in growth yield of grain and stover were due to use of 60 kg phosphorus and 10 kg zinc in form of EDTA.

Keywords: *Phosphorus, Zinc, Fertilizer, Mustard, Kaymor, Plateau.*

INTRODUCTION

India occupies premier position in global oil seed scenario. Among different oil seed crops, rapeseed mustard is an important group. It is cultivated in 20 states in northern and Western planers of the country out of which 30 per cent area in rain fed, during 2004-05, the area under rapeseed mustard went up to 6.85 m ha with a production of 8-36 million tonnes. The rapeseed mustard contributed 25.3 per cent in acreage and 32 per cent to the total our seed production in the country (Rai 2006). The major rapeseed- mustard growing states are Rajsthan, Uttar Pradesh, Haryana, Madhya Pradesh and West Bengal, The Madhya Pradesh grows rapeseed and mustard on an area of about 286.2 thousand hectare with the production of 141.7 thousand tonnes seed in the state. Major mustard growing areas in order of merit are Morena, Bhind and Mandala district. Bundlekhand, entire Madhya Pradesh grows mustard on sizeable area with considerate production.

The oil of mustard is being widely used for edible purpose. It is intensively area for frying of vegetables, pulses and fishes because of its particulars taste and pungency of mustard oil is due to allylisothio cyanate and related compound present in it. Berides edible purposes, a small portion of mustard oil is also used for various other purposes like tear gas, preparation of varnishes, plasticizers and synthesis of certain medicine. The cake is very much preferred by milchs cattes and fed to other

animals as diet in the country.

Despite impressive demand of oil in country. Supply has been set back due to various constraints, Changing environmental condition and ilcit policies of government per capita consumption of edible oil has arisen. In this way, total demand in the country has arisen at a very high rate and has created big gap between domestic production and consumption. Situation indicates need of increasing oil seeds production in the country through area expansion and productivity improvement. There is hardly any scope to bring additional area under oil seed on the demand of land for producing other remunerative crops will increase the productivity of oil seeds as well as reduce the dependence on one crop. Although oil seeds crops are grown in energy rich areas but mostly they are grown under energy starved conditions. low or no use of plant nutrient is another factors that hinders crops productivity. In case of rain fed mustard either no fertilizer is used or small quality of nitrogenous fertilizer is applied. The research evidence showed that application of phosphorus. Is mustard is as important as nitrogen, Being energy rich crop, the nutrient requirement of mustard is high for all the nutrient which needs to be supplied in adequate quantities for high yield.

Phosphorus is an essential plant nutrient next to nitrogen and required in large quantity for better crop growth. It is involved with wide range of plant processes from cell division to the development of good root systems ensuring timely and uniform ripening off the crop and performs a number of functions related to growth development, photosynthesis and utilization of carbohydrate. During early stage of plant growth, Phosphorus accumulation may proceed faster than dry matters production indicating the need for concentration for active vegetative growth and root proliferation.

Among micronutrients zinc deficiency is the most common soil disorder which limits the crop fields. Problems arise more in coarse textured soil because total oil zinc has negative and negative and significant correlation with sand fraction (Kanwar and Tripathi, 1984). Mustard soil are generally coarse textured, thus proper application of zinc is necessary for better yield. Zinc is constituent of several enzymatic systems which regulate various metabolic reactions in the plant. The soils of chitrakoot area are generally sandy loam type where mustard crop is expected to respond to zinc application because of low zinc status in soil. Keeping this view in mind present research was conducted.

MATERIALS AND METHODS

This experiment was carried out in rabi season at instructional farm, rajaula at Mahatma Gandhi Chitrakoot Gramodaya, Viswavidyalaya Chitrakoot, Satna , M.P.. University farm is situated in bundelkhand region of northern Madhya Pradesh; Geographically chitrakoot is situated at the 25^0 north latitude and $85^0$52 E longitude and about 190-210 meter above sea level. The soils of rajaula farm are of sandy loam in textures and poor in fertility in order. It determines the texture class and fertility status of experimental field. Soil samples from 0-30 an on soil depth were collected from different places of experimental area before sowing and fertilizer application, such soils were analysed for various physicochemical properties. Soil possessed PH. (1; 2.5 Soil water suspension) 7.27, organic carbon (%) 0.22, available nitrogen (kg ha^{-1}) 99.47, available phosphorus 13.21, available potassium 114.0 kg ha^{-1}, and available Zinc 0.32 (mg/kg^{-1} soil). In present 12 treatment combination of 4 phosphorus and 3 doses zinc level were tried. A layout of

experimental trial was prepared. total no of plants were 36, each plot had size of 4.0x2.4 m. with row space. 30 cm apart and plant spacing 15 cm. variety of mustard was Varuna proccured from C.S.A. University Kanpur. UP.

Ploughing and planking were done to make a fine and pulverized soil necessary for proper germination of mustard seeds. A uniforms application of 10 tonnes ha^{-1} F.Y.M. was done in whole area about one month prior to sowing. A common dose of 60 kg N ha^{-1} through urea and 30 kg $k2o^{-1}$ through MOP was applied at the time of last ploughing for field preparations uniform to whole area as band placement. Phosphorus was applied as per treatment through DAP at sowing in seed furrows below the seed with the help of attached funnel for zinc; EDTA (water solute with 12 per cent Zn) was applied. The seeds of variety Varuna were sown using 7 kg seed ha^{-1} in furrows, 30 cm apart. After completion of germination at 20 days stage extra plants with row were thinned out by leaving plant 12-15 cm apart.

RESULTS AND DISCUSSION

The data recorded on final plant stand were furnished in table-1 and result has been described under various heads.

1. **Plant height:**

Result data shifted in table-1 reveals that the rate of increase in plant height was more from 30-60 DAS stage than plants at 60-90 days irrespective of treatment. On an average plant at 60 days were measured 134.7 per cent more than plants at 30 DAS while increase was found only 30 per cent in between 60 and 90 days stage. As regards treatment, effective increasing levels of P increased plant height up to high dose of 60 kg/ha^{-1} at as stage.

At initial stage of 30 DAS, 60 kg level recorded significantly highest plant height while at 90 DAS height increased significantly over control. At 20, 40 and 60 kg P application ha^{-1}, there was increase in mean plant height over control by 5, 7, 10-4 and 14.3 per cent respectively.

Effect of zinc application was found significantly only at first stage of 30 DAS when 10 kg Zn being at par with 5 kg Zn produced significantly taller plants than without Zinc application. Application of 5 and 10 kg Zn ha^{-1} increased mean plant height by 4.4 and 14.4 per cent over control respectively. The trend was similar taller at both stage of 60 and 90 DAS. But differences would not reach to the level of significance. Interaction between a Zn was not found significant on plant height at any stage of observation.

2. **Number of primary branches/plant :**

Number of primary branches increased with the age of plant. The application of P increased the number of primary branch significantly at all stage of observation increasing levels of P. Increasing number of primary branches up to height level of 60 kg P. but increase beyond. 40 kg P level was not significant at any stage. At final stage of harvest the application of 20, 40, and 60 increased number of primary branches by 11.3, 21.4 and 31.1 per cent respectively. The effect of zinc application on primary branches was found significant at latter stage of 90 DAS and harvest stages where 10 kg Zn/ha^{-1} being at par with 5 kg Zn/ha^{-1} produced more number of primary branches over control. At final stage of harvest, application of 5 and 10 kg Zn/ha^{-1} increased primary branches over control by 10.1 and 14.9 per cent respectively. Interaction between treatment factors was not found significant at any stage of observation.

Number of Secondary branches:

From data it was recorded that there was not much differences in secondary branches of 90 DAS and harvest stage. On an average, Secondary branches from 60 DAS to 90 DAS at harvest stages increased by 59.3 and 67.4 per cent respectively. Significant increase in secondary branches at each level of up to 40kg P was recorded. 40 kg P at par with 20 kg p ha^{-1} produced significantly more number of secondary branches over control at all stages of observation. At final stage of harvest, the application of 20, 40 and 60 kg/ha^{-1} increased the number of secondary branches over control by the margin of 8.7, 16.6 and 22.2 per cent respectively.

The number of secondary branches $plant^{-1}$ was influenced significantly by Zn level. Only at later stage of 90 DAS at harvest. At the stage of 90 DAS, 10kg Zn ha^{-1} could produce significantly more secondary branches only over control while at harvest stages. 10kg Zn produced significantly more secondary branches over control $palnt^{-1}$ by the margin of 5.9 and 16.4 per cent respectively, The interactions of PX Zn was not significant.

Total number of branches/ plant-

Data shifted in table-1 revealed that total branches increased with age of plant and maximized at harvest stage. On an average increase in branches from 60 DAS to 90 DAS and harvest stage were found at 47.0 and 51.5 per cent respectively. It was observed that total number of branches improved by increasing level of P. There was no significant difference in growth improvement at 40 and 60 kg P level at all stages. At all stages of branches increase in growth of plant at 20, 40 and 60kg P level over control were recorded to be 11.0, 21.0 and 29.c per cent respectively.

Root length:

It is evident from data shifted in table-1 that root length was influenced significantly by only phosphorus application while the effect of Zn or interaction- PX Zn were non significant. Root length increased with age of plant 2 and maximized remarkedly at last stage of 90 DAS; On an average of all treatment root length increased from 30 DAS to 60 and 60-90 DAS stage 117.5 and 230.9 per cent respectively. Increasing levels of P increased root length up to the application of 60 kg P ha—^{1} at all stage of observation however, the dose of 60 kg P ha^{-1} produced significantly long length root only as compared to control. At last stage of 90 DAS, increases in root length with 20, 40 and 60 kg/ha-1 over control were calculated to be 4.9, 9.3 and 13.4 per cent respectively. Effect of Zn application was not significant on root length.

Dry weight of root:

Data revealed that dry weight of root increased with age of plants and maximized at 90 DAS stage. On an average increase in dry root weight from 30 to 60 days stage was 1.48 $plant^{-1}$ or 100.2 per cent while from 60- 90 days stage increase in root dry weight was recorded 1.703g $plant^{-1}$ or 57.5 per cent. Significant response of P was up to 40 kg/ha^{-1}. The rate of increase in root dry matter with application of 20, 40 and 60kg/ha^{-1} area control were found 11.3, 18.7 and 25.7 per cent respectively at final stage of 90 DAS.

The effect of Zn was found significant on dry root weight only at stage. 30 DAS when 10 kg/ha^{-1} being at par with 5kg Zn ha^{-1} accumulated more root dry matter significantly over control

At final stage of 90 DAS, 5 and 10 kg Zn application increased root dry matter over control by margins of 4.9 and 6.9 per cent respectively. The interaction of each effect (PX Zn) was found non significant on this trait of mustard crops.

Dry matter per plant:

Dry matter accumulation pant^{-1} increased with age of plant and maximized at final stage of 60 DAS. On average basis of all treatments increases in plant dry matter form 30 DAS to 60 DAS was computed 8.15g plant-1 or increase was found 16.73 g plant^{-1} or 125.2 per cent. Thus plant dry matter accumulation was much higher (about 2 time) between 60 and 90 DAS as compared between 30 and 60 DAS stages. Dry matter per cent increased with increasing level of P up to 60 kg/ha^{-1} but increase over 40 kg/ha^{-1} was not found significant at any of observational stage.

However P level was more pronounced at initial stage of 30 DAS when 20, 40 and 60 kg/ha^{-1} increased plant dry matter over control by margins of 21.9, 39.9 and 54.6 per cent respectively at the stage of 60 DAS, margins of such increase remained 17.1, 29.7 and 37.9 per cent and at last stage of 90 DAS, 11.2, 12.9 and 23.0 per cent respectively.

Dry matter per plant was influenced significantly by Zn level only at initial stage of 30 DAS when 10 and 5kg ha^{-1} Zn level being at par with each other produced significantly more dry matter over control. The trend was almost similar at later stage of 60 and 90 DAS but differences between Zn levels was not of significant. The interaction effect PX Zn was not found significant on dry matter plant^{-1} at any stage of observation however combined effect on use of 60kg p+10kg Zn ha^{-1} accumulated numerically maximum of 33.68g plant^{-1} dry matter.

Number of Siliqua Plant^{-1}

Observed data revealed that siliqua plant^{-1} was influences by both of the factors and Zn, each increasing P level increased the number of siliqua plant^{-1} significantly up to 40 kg P ha^{-1} beyond which increases siliqua number but was not significant. The application of 20, 40 and 60 kg P ha^{-1} increased siliqua number over control by the margins of 17.6, 32.1 and 42.2 per cent respectively.

Increasing level of Zn also increased the siliqua number up to 10 kg Zn ha^{-1} but the differences between 5 and 10 kg Zn and between zero and 5 kg Zn was not significant. However 10kg Zn produced more number of siliqua over control by the margin of 11.3 per cent. Interaction effect of PX Zn was not found significant. Combined application of 60 kg P+10 kg Zn ha^{-1} produce numerically maximum of 425.67 siliqua plant^{-1}.

Number of seed per siliqua :

It was also affected significantly by both of the treatment factors P and Zn: Each increase in P level enhanced the number of seeds significantly up to 40kg/ha^{-1} beyond which a non significant increase in seed number was noted highest level of 60kg/ha^{-1}. The 20, 40 and 60 kg P ha^{-1} increased the number of seed siliqua over control by the margin of 6.9, 10.5 and 12.5 per cent respectively.

In case of Zn application 10kg Zn ha^{-1} being at par with each other produced significantly more number of seeds siliqua over control treatment. Introduction of PX Zn was not found significant in this case also but combination of 60 kg P+ 10kg Zn ha^{-1} produced maximum of 13.95 seeds siliqua^{-1}

Weight of 1000 seed:

The weight of 1000 seeds was affected significantly by main effect of P only. It increased with increasing P level up to 60kg P ha^{-1} but increase beyond 40kg/ha^{-1} was not found significant. The application of 20, 40 and 60kg P level increased last weight over control by the margin of 6,9, 12.0 and 14.1 per cent

respectively.

Harvest index

The harvest index was worked out and is apparent from table that harvest index was affected significantly only by the main effect of Zn levels. Up to 10kg Zn ha^{-1} where significantly maximum 21.41 percent index was recorded. It was found 6.1 and 3.3 per cent higher than zero and 5 kg Zn levels respectively. Increasing P level also improved harvest index but margin of increase was very nominal and non significant. Interaction of PX Zn was also found to be non significant on harvest index.

Biological yield:

Biological yield of mustard was influenced significantly only by p levels. Increasing P levels increased biological yields up to close of 40 kg/ha but increase in yield of 20kg /ha^{-1} produced significantly higher biological yield as compared with yield in control treatment but further increase in yield beyond 20kg/ha^{-1} was not significant. The margin of increase in biological yield at 20, 40 and 60 P as compared to yield in control treatment was found 7.48 q ha^{-1} or 14.7 per cent and 11.71 q/ha or 23.0 per cent and 11.46 q/ha or 22.5 per cent respectively.

Effect of Zn was not significant on biomass production but numerically Zn application at 5 kg ha^{-1} increased yield over control by the margin of 3.36 q ha^{-1} or 6.0 per cent. Interaction effect of PX Zn was found no significant on biological yield of mustard.

Table-1 influence of phosphorus and Zinc level on growth attributes of mustard crop.

Treatment's	Plant height (cm) 90 DAS	Primary branches/Plant	Secondary branches/Plant	Total branches of plant	Plant dry weight (gm)	Root length (cm) 90 DAS	Root dry weight (gm) 90 DAS
0	124.72	7.20	11.55	22.69	26.59	24.76	4.09
20	131.77	8.01	12.55	25.18	29.56	25.98	4.55
40	137.63	8.74	13.47	27.45	31.36	27.07	4.86
60	142.55	9.44	14.11	29.28	32.71	28.08	5.14
CD(5%)	12.97	1.00	1.14	2.98	3.23	2.67	0.48
Zinc level (kg/ha)							
0	131.86	7.70	12.00	24.36	29.03	26.31	4.48
5	133.69	8.48	12.74	26.14	30.18	26.51	4.71
10	136.96	8.85	14.00	27.95	30.97	26.60	4.80
CD 5%	NS	8.87	1.23	2.58	NS	NS	NS
Interaction (PxZn) Cd 5%	NS	NS	NS	NS	NS	NS	NS

Seed yield :

Seed yield of mustard was influenced significantly by P and Zn application while the effect of PX Zn interaction was not found significant on seed yield. An application of 40kg Pha^{-1} increased seed yield significantly over control and 20kg P. but further increase in P at 60 kg ha^{-1} level reduced the seed yield by 66 kg ha^{-1} or 4.9 per cent as compared to yield at 40kg/ha^{-1}. The seed yield response of 20kg/ha^{-1} was calculated to be the highest of 8.60kg seed kh^{-1} P applied, It was followed by seed responses of 7.85 and 4.13 kg seed kg^{-1} P at 40 and 60kg P level respectively.

Differences in seed yield due to zinc level showed that 5 and 10 kg Zn ha^{-1} increased seed yield over control by margins of 1.00 q ha^{-1} or 8.8 per cent and 1.41 q ha^{-1} or 12.4 per cent with seed yield response of 20.0 and 14.1kg seed kg-1 zinc applied. The application of 10kg Zinc ha^{-1} or significantly higher to produce yield over control. Interaction effect was not found significant on seed yield . however numerical basis, the combination of 40kg P and 10kg Zn ha^{-1} produced highest seed yield.

Stick yield:

Stick yield was influenced significantly only by main effect of P levels. Increasing P levels increased yield up to. 60kg P ha^{-1} but increase beyond 20kg ha^{-1} was not significant. The P level of 20, 40 and 60 kg P ha^{-1} increase stick yield over control by the margins of 14.0, 21.7 and 22.0 per cent respectively.

Although the effect of zinc application was not significant but numerically 5kg Zn ha^{-1} produced 3.3 per cent more stick yield than control. Interaction was not found significant.

Stover yield:

Stover yield was influenced significantly by mean effect of both P and Zn level. Increasing level of P increased yield up to

Table -2 Influence of phosphorus and zinc level on yield attributes of mustard crop

Treatment's	Siliqua/ plant	Seed in /siliqua	Seed weight / plant	Test weight	Harvest index	Biological yield (q/ha)	Seed yield (kg)	Stick yield (kg)	Stover yield (q/ha)
0	284.33	12.16	6.42	3.91	20.33	50.85	10.30	29.35	11.17
20	334.44	13.60	7.86	4.18	20.66	58.33	12.06	33.46	12.15
40	375.56	13.44	9.59	4.38	20.91	62.56	13.48	35.72	13.37
60	404.22	13.68	9.49	4.46	21.18	62.31	12.82	35.81	13.68
CD(5%)	32.23	0.43	0.66	0.13	NS	6.30	1.37	3.63	1.45
Zinc level (kg/ha.)									
0	330.58	12.74	7.88	4.17	20.18	56.28	11.37	33.13	11.79
5	350.50	13.16	8.36	4.25	20.72	59.64	12.37	34.22	12.79
10	367.84	13.32	8.78	4.27	21.41	59.60	12.78	33.45	13.49
CD 5%	27.91	0.37	0.57	NS	0.57	NS	NS	NS	1.25
Interaction PxZn cd (5%)	NS	NS	NS	NS	NS	NS	NS	NS	NS

60kg/ha^{-1} increased beyond 20kg/ha^{-1} was not significantly. However 40kg p yielded higher stover significantly over control. The rate incensement mean in yield of stover yield with 20, 40 and 60 kg p level over control were found to be 12.01, 19.7 and 22.5 per cent respectively. In case of zinc level 10kg Zn ha^{-1} produced significantly more stover than control by margins of 14.2 per cent. Interaction PX Zn was found non significant.

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EFFECT OF FOLIAR APPLICATION OF GA_3 AND MICROELEMENTS ON VIGOUR AND FLOWERING BEHAVIOUR OF AFRICAN MARIGOLD (*TAGETS ERECTA*) C.V. DOUBLE AFRICAN YELLOW

Manoj Kumar Singh and Hemlata Pant

Department of Horticulture, K.A.P.G. College Allahabad-211001, (U.P.), India

Society of Biological Sciences and Rural Development, Allahabad-211019, (U.P.), India

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ABSTRACT

Arnon's criteria of essentiality universally proven as it always emphasis on supplication all 17 elements. Each element has its definite role in plant metabolism hence growth and development. Results of the field experiment revealed that vigour of marigold plant was significantly increased due to foliar application of NAA and microelements. The production and size of floral heads were also improved significantly by the NAA and microelement treatments. The spray of 150 ppm NAA for 15 days after transplanting and of 0.50% $CuS0_4$ for 30 days after transplanting proved significantly effective for a floriferous crop of African marigold c.v. Double African Yellow.

Key words*: Vigour, NAA, micronutrients, african marigold, yield.*

INTRODUCTION

Marigold *(Tagetes erecta* L.) is commonly used for cut and loose flowers in India because of ease in cultivation and adaptability to varying soil and climatic conditions, long duration of flowering and attractively coloured flower heads of excellent keeping quality. The significance of microelements in manurial schedule of horticultural crops has been recognized only in the recent years. Increasing interest has been observed in the use of P.G.R. like NAA in vigour promoting substances. However, information on the effect of NAA and microelements like Copper and Borax on ornamental crops is rather meager. Therefore, an experiment was conducted to study the influence of foliar application of NAA, Copper and Borax on vigour and flowering behaviour of African marigold c.v. Double African Yellow.

MATERIALS AND METHODS

The field experiment was conducted during the winters in 2013-14 at the Department of Horticulture Kulbhasker Ashram Post Graduate College, Allahabad, Uttar Pradesh. The soil of experimental area was loamy sand with good moisture-holding capacity and pH 7.8. The treatments of foliar application 0.0, 100 and 150 ppm concentrations of NAA noted as N_0, N_1, N_2 respectively, along with 0.0%, 0.25% and 0.50%, Copper Sulphate (M_o, M_1, M_2) and

0.15% and 0.30% Borax noted as M_3, M_4, respectively forming fifteen(5x3=15) treatment combinations, were tested in the Randomized Block Design with four replications. The seedlings of 30 Days old were transplanted on November 05, 2013 at 45 cm x 45 cm spacing. FYM was applied to all the plots uniformly @ 1.5 kg per M^2 as basal dose before transplanting along with 5 g each of P_2O_5 and K_2O through di-ammonium phosphate and muriate of potash, respectively. The crop was top-dressed only once with 6 g per M^2 of nitrogen through urea at 45 days after transplanting.

The parameters of vigour and flowering were recorded at the full blooming stage in the first week of March.

RESULTS AND DISCUSSION

Effect of NAA on plant vigour: A significant change in the vigour parameters was recorded due to NAA spray. The fresh weight of biomass increased profusely due to application of 150 ppm NAA with simultaneous increase in the plant height, diameter of main-stem, spread of plant along and across the row, number of primary branches and number of leaves on the longest primary branch. The application of 100 ppm NAA was also found significantly effective over control in improving plant vigour but 150 ppm NAA was significantly more effective than its 100 ppm. These results are in close conformity with those of Charani (1987). The increase in number of branches and leaves with the spray of NAA might be due to the fact that NAA increased photosynthetic efficiency on account of stabilization of chlorophyll (Rana and Vashistha, 1985). The improvement in length of the longest primary branch due to application of NAA might be due to increased plant vigour which promotes rooting and improves efficiency of nutrient uptake. Overall increase in biomass may be attributed to the fact that NAA increases CO_2 fixation, chlorophyll content of leaves and assimilation.

There has been significant increase in the number and weight of flower heads per plant due to NAA spray. The increase in fresh weight of floral heads with the spray of NAA over control might be due to mobilization or movement of nutrients in to flowers. Similar effect of NAA has been reported by Hooda *et at.* (1983). The size of the floral head was also improved significantly over control by the application of NAA. Such changes in the size of floral head and their number per plant were due to NAA application which may be attributed to mobilization of auxins and metabolites. The duration required for full blooming since transplanting was increased by the application of NAA. The duration required for full blooming since transplanting was 98.07 days which decreased to 94.40 and 91.30 days when the plants were sprayed with 100 ppm and 150 ppm of NAA, respectively.

Effect of micro-elements on vigour and flowering

Foliar application of Copper Sulphate particularly at 0.50% concentration caused positive modifications in the vigour parameters such as increased plant height, diameter of main-stem spread, of plant along and across the row number of primary branches per plant, length of the longest primary branch, number of secondary branches on the longest primary branch and number of leaves on the longest primary branch, mainly due to participation of zinc in the metabolism of plant as an activator of several enzymes such as

Table 1: Effect of foliar application of NAA and micro-elements on Vigour parameters of African marigold c.v. Double African Yellow.

S.No	Treatments	Concentration of NAA (ppm)			CD	Concentration of microelements					CD
		0.00	100	150	at 5%	0.0%	0.25% $CuSO_4$	*0.50%* $CuSO_4$	0.15% Borex	0.30% Borex	at 5%
I.	Plant height(cm)	57.32	59.18	61.12	0.94	58.96	58.84	59.36	59.27	59.27·	1.21
2.	Diameter of main stem (cm)	1.58	1.73	1.79	0.06	1.62	1.56	1.73	1.74	1.75	0.07
3.	Spread of plant 'along the row(cm)	37.18	39.04	40.16	0.69	37.61	38.51	39.03	39.16	39.26	0.89
4.	Spread of plant across the row(cm	36.78	39.07	39.39	0.92	37.51	33.51	38.83	39.23	39.67	1.19
5.	Number of primary branches on the plant	10.78	12.07	13.20	0.29	11.52	11.72	12.00	12.40	12.78	0.37
6.	Length of the longest primary branch (cm)	34.69	38.00	40.85	0.60	35.98	36.85	38.48	38.65	39.16	0.78
7.	Number of secondary branches on the height primary branch	5.82	6.44	6.97	0.30	5.97	6.28	6.45	6.65	6.70	0.39
8.	Number of leaves on height primary branch	35.52	43.22	47.59	0.74	39.77	40.75	32.38	44.27	44.38	0.95
9.	Fresh weight of plant canopy(g)	279.50	315.15	358.45	8.96	301.17	307.17	317.50	323.50	338.42	11.57

carbonic anhydrase, alcohol dehydrogenase and pyridine nucleotide dehydrogenase. Similar effect of $CuS0_4$ on crop plants have been reported by Barman and Pal (1993). The effect of $CuS0_4$ treatments was significant on the fresh weight of plant canopy as evinced by the application of 0.50% spray of $CuS0_4$ which produced the maximum fresh weight of bio-mass (317.50 gm) being significantly more over other treatments (M_o and M_1).

Likewise, there were considerable manifestations in the vigour characters due to Borax spray. Borax has been capable of acting as electron carrier in enzyme system which brings about rapid oxidation-reduction in plants. The foliar application of Borax increased the plant height over M_0 (control). The Borax treatment significantly increased the diameter of main-stem simultaneously and also the spread of plant along and across the row. Under M_0 the values of these parameters were 37.61 cm and 37.51 cm in comparison to 39.26 cm and 39.67 cm, respectively with the application of 0.30% Borax. These results clearly prove the Vigour-promoting effect of spray of 0.30% Borax. The number of primary branches and length of the longest primary branch also increased significantly by the foliar application of Borax (0.30%). As a result, the fresh weight of plant canopy increased significantly over control by the foliar application of Borax.

The effect of Copper Sulphate, treatment was significant on the duration required for full blooming. The size of the largest floral head with the application of 0.50% $CuS0_4$ spray has been increased significantly over control. Similar effect of $CuS0_4$ spray was noticed on the number of floral heads per plant accomplished with significant superiority of M_4

(19.58) over M_0 (15.91). These results are in consonance to those of Rathore *et al.* (2000). The fresh weight of floral heads per plant (51.08) with the spray of 0.50% Copper Sulphate, also increased over control (46.25g). Similar effects of Copper Sulphate have been reported by Ganta and Mitra (1993).

The duration required for full blooming was reduced significantly by the application of 0.30% Borax. A similar impact of Borax was also noted on the size of the largest floral head. The number of floral heads per plant under the influence of 0.30% Borax (M_4) also revealed significant increase over control (M_0). Thus, foliar application of Borax brought about prolific flowering which coincided with the results reported by Bandopadhyay *et al. (1998).*

Table 2: Effect of foliar application of NAA and micro-elements on flowering behaviour of African marigold c.v. Double African Yellow.

S.No.		Concentration of NAA (ppm)				Concentration of micro elements percent					
	Treatments	N_0	N_1	N_2	CD	M_0	M_1	M_2	M_3	M_4	CD
		0.0	100	150	at 5%	0.0	0.25 $CuSo_4$	0.50 $CuSo_4$	0.15 Borax	0.30 Borax	at 5%
1.	Duration required full blooming (Days)	98.07	94.40	91.30	0.48	96.14	95.61	45.44	93.06	93.69	0.52
2.	Size of the largest floral head(cm)	9.92	10.20	10.33	0.08	10.01	10.07	10.19	10.25	10.22	0.10
3.	Number of flower heads per plant	15.91	18.05	19.76	1.05	16.90	17.10	17.45	19.58	18.50	1.35
4.	Fresh weight of floral head per plant (g)	46.25	49.90	56.10	1.70	48.33	49.42	51.08	52.75	52.17	2.20

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INFLUENCE OF URBANIZATION ON AGRICULTURAL ACTIVITIES IN UTTAR PRADESH.

Hargovind Bhargav
Department of Agricultural Economics
K.A.P.G. College, Allahabad - 211 002, (U.P.), India

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ABSTRACT

The result revels that high-value commodities generate larger returns to land, labour and capital, and an easy market access enables farmers, especially small farmers to enhance their income and employment in high-value agriculture, high-value commodities have considerable potential for value addition and therefore can generate further employment and income opportunities in processing and marketing of value added products for rural as well as urban poor.

Keywords: Food commodities, Urban population, Agricultural activities, Horticultural crops, Transportation, Urban surrounded districts.

INTRODUCTION

Urban and peri-urban population in India is growing rapidly, between 1981 and 2005 the urban population grew at an annual rate of 2.9 percent, higher than the growth in total population (2.0 percent). The rapid increase in urban population is the outcome of both pull and push factors for example better employment opportunities and higher wages in urban labour market, slow growth in rural non-farm sectors and continuously declining land holding size are causing rural to urban migration. In 2005 about 29 percent of the country's total population was urban and it is estimated that by 2030 the urban population will account 41 percent of the total population (FAOSTAT, 2009).

The expanding urbanization together with higher economic growth and changes in the tastes and preferences are causing a shift in the food basket in favour of high value food commodities like fruits, vegetables, milk, meat , egg and fish (Kumar *et. al.,* 2007). These changes in the food basket are leading to transformation of the agricultural production portfolio away from food grains towards high-value food commodities (Joshi *et. al.* 2004, Birthal *et. al.* 2007). This process is likely to continue as the trends in the factors (urbanization and economic growth) underlying this process have been quite in the recent past and are unlikely to subside in the near future (Pingali and Khwaja 2004). In recent years, some studies have examined the role of urbanization in augmenting agricultural diversification at the national level (Joshi *et. al*., 2004, Partha sarathy Rao *et.al*., 2006).

However, the influence of urbanization on agriculture can be better understand if examined at a disaggregated level that is meso/micro level. In this paper we examine the effect of urbanistion on composition of agricultural sector in Uttar Pradesh, where 27 percent of the total population lives in urban areas. Specifically, the paper (i) Compares the differences in agricultural activities between urban and hinterland districts and (ii) Identifies key factors in addition to urbanization, responsible for the spatial differences in agricultural activities, farmers living in urban and urban-surrounded districts have an easy access to markets for high-value commodities, information, technology, inputs an services and hence face lower transaction and transportation costs. Thus we hypothesise that agriculture is more diversified towards high-value food commodities in urban and peri-urban districts. To test this hypothesis we use district level data on key agricultural activities and socio-economic and demographic parameter for Uttar Pradesh.

The paper is organized into four sections. The following section describes the methodology and database for the study. Section III provides a brief overview of the changes in the food basket and agricultural production portfolio in Uttar Pradesh. Section IV examines the influence of urbanization on agricultural activities and concluding remark in the final section.

MATERIALS AND METHODS

This study uses the district level database for Uttar Pradesh from 1980 to 2003. The database includes all relevant and key variables related to crops, livestock, fisheries, land use, input use, infra-structure, agro-climate, socio-economy and demography. For this analysis the districts were divided into two groups : urban and urban surrounded districts and hinterland districts. The shares of different commodities in the total value of agricultural output were compared between these two groups to examine the influence of urbanization on agricultural activities. Besides multivariate analysis was carried out using cross section district level data for the year 2012-13, to further substantiate the role of urbanization in determining the composition of agricultural activities. We regressed the value share of an activity on urban population and other demand and supply side factors such as farm size, wages, credit and infra-structure. Ordinary least squares (OLS), to bit and seemingly unretated regression estimates (SURE) techniques were used.

RESULTS AND DISCUSSION

IOur findings indicate a larger concentration of high-value food commodities in the urban and peri-urban areas than in hinterland /rural areas. Growing urbanization, both in terms of population and income generated demand for agricultural commodities. For perishable commodities whose market are not spatially integrated due to high transportation costs, the growing demand is largely met by urban and urban-surrounded districts, while other agricultural products can be procured from locations farther away from urban centers, besides urban demand a well-developed infra-structure (roads, electricity, cold storage, processing input markets, information source etc.) in urban areas encourages farmers to diversify towards high-value perishable food commodities.

The results have some important implications. First high-value commodities generate larger returns to land, labour and capital, and an easy market access enables farmers, especially small farmers to enhance

their income and employment in high-value agriculture. Second high-value commodities have considerable potential for value addition and therefore can generate further employment and income opportunities in processing and marketing of value added products for rural as well as urban poor. Third, farmer in remote locations however may remain deprived of the benefits of urbanization induced growth in high-value agriculture due to transport and infra-structure bottlenecks. Hence to enable them to benefit from the growing demand for high-value food commodities it is imperative to invest in infra-structure such as roads, cold storages and processing facilities in area farther away from urban centers that have considerable potential of high-value food commodities.

CHANGES IN FOOD BASKET AND PRODUCTION PROTFOLIL

During the last four decades, food basket of urban as well as rural consumers in Uttar Pradesh has undergone a significant change away from cereals towards horticultural and animal products. While the share of food grains in Urban food expenditure declined from 49 percent in 1977-78 to 35 percent in 2004-05, the shares of high-value food commodities (fruits, vegetables, dairy products, meat, egg and fish) increased from 27 to 34 percent (Table 1), similar changes are also observed in the rural consumption pattern. The share of high-value food commodities in rural food expenditure increased from 20 percent to 30 percent during this period. Nonetheless, urban consumers spend more on high-value food commodities than do the rural consumers.

The tendency of shift in food basket in favour of high-value commodities is likely to be stronger in the years ahead, income elasticity of demand for high-value food commodities in higher than for staple food grains (Kumar *et.al*. 2007), implying faster growth in demand for these commodities with sustained rise in percapita income. The growing demand will have to be met through domestic production and /or imports from other states or countries. These changes in food basket have been accompanied by a gradual change in agricultural production

Table 1: Composition of food basket in Uttar Pradesh :

(Percent share of food expenditure)

Food Item	Urban		Rural	
	2000-01	2012-13	2000-01	2012-13
All cereals	42.7	29.5	55.9	38.2
Pulses	2.8	5.4	4.9	6.0
Milk and milk product	11.2	14.8	7.2	10.6
Edible oils	6.4	7.6	5.2	8.7
Meat, egg, fish	7.8	7.4	6.3	7.8
Vegetables, fruits	8.4	13.0	6.7	13.4
Other food items	18.5	23.1	13.8	18.4
Total food	100.00	100.00	100.00	100.00

Source – Various NSS rounds on consumer expenditure survey published by the sample survey organization, Government of India.

portfolio toward high-value food commodities. Table 2presents changes in the agricultural production portfolio in Uttar Pradesh. The share of high-value food commodities in total value of agricultural output increased from 29.1 percent in TE (Triennium Ending) 1998-99 to 50.3 percent in TE 2010-11, while the share of food grains declined from 37.6 to 25.1 percent. Changes in the production portfolio were more pronounced during 1990s. Amongst high-value food commodities, the share of animal products (including fish) experienced a substantial increase in their share from 17.7 percent in TE 2004-05 to 24.5 percent in TE 2009-10 and further to 40.7 percent in 2012-13. The growth during 1990s was driven by poultry and fish production. The performance of horticultural crops however was not as bright, the share of fruits and vegetables in the total value of agricultural sectors has remained around 10 percent during this period.

Table 2: Composition of the Agricultural sectors of Uttar Pradesh

(Percent share of total value of agricultural commodities at 2000-01 prices)

Commodities	TE 2004-05	TE 2008-09	TE 2012-13
Cereals	34.4	28.5	21.4
Pulses	3.2	3.5	3.7
Commercial crops	22.6	27.9	19.6
Fruits & vegetables	11.3	8.7	9.6
Milk	8.9	9.5	12.9
Meat	4.3	7.1	12.1
Eggs	1.2	1.5	3.6
Fish	3.3	3.8	10.0
Other animal products	Neg	2.6	2.1
High-value commodities	29.1	33.1	50.3
Total value in million Rs.	1,45,327	2,02,421	2,98,334

Sources – Government of India.

a- Commercial crops include oilseeds, cotton, chilies, turmeric an sugar

b- High-value commodities include fruits, vegetables, milk, meat, eggs, fish and other animal products.

URBANIZATION AND AGRICULTURAL ACTIVITIES

We expect agricultural production to be more diversified towards high-value food commodities in urban and urban surrounded districts because most high-value commodities are perishable and require immediate transportation to the demand centers and the urban and urban-surrounded districts have better transportation and infra-structure facilities. In order to probe this hypotheses we examine and compare the composition of agricultural sector in urban an urban-surrounded group of districts and hinterland districts. A district with more than one million urban population was classified as urban-

surrounded districts. Rest of the districts was classified as hinterland districts. The physical output of the agricultural sector of each of the district was converted into monetary value by multiplying the production of commodities with their respective prices.

Table 3, presents the shares of different agricultural activities in the total value of agricultural sector of the urban-surround and the hinterland districts. The average share of high-value commodities in the total value of agricultural production is higher in the urban and urban-surrounded districts (39 percent) than in hinterland districts (27 percent).

Table 3: Share of commodities in the value of Agricultural ommodities by level of Urbanization 2000-01 (at 1990-82prices)

Commodity	District group	
	Urban and urban-surrounded	Hinterland
Paddy	28.5	25.1
Course-cereals	2.6	7.4
Pulses	4.3	3.2
Oilseeds	4.2	13.0
Sugarcane	5.4	2.1
Cotton	2.9	7.8
Chillies	5.3	5.2
Turmeric	0.9	7.6
Tobacco	2.8	0.4
Food grains & commercial crops	61.0	72.8
Fruits	11.9	6.2
Vegetables	2.2	1.2
Horticultural crops	14.1	7.4
Milk	15.4	11.2
Bovine meat	0.6	0.8
Ovine meat	1.1	1.8
Pig, poultry meat, eggs	7.7	6.0
Livestock	24.9	19.8
High-value commodities	39.0	27.2
Total value (Million Rs.)	68973	19,408

a- alue of fisheries sectors is not included.At the commodity level, the share of fruits and vegetables in the total value of agricultural production is 14 percent in the urban and urban-surrounded districts, which is almost twice their share in the hinterland districts. The share of animal products is higher in the urban and urban-surrounded districts, the difference is not as large as for fruits and vegetables. Together, milk, meat and eggs

Table – 4 Factors influencing spatial distribution of high-value Agricultural Commodities, 2012-13.

Variables (Units)	HVCs Tobit Elasticity coefficient (t-ratio)	Fruits		Vegetables		Poultry, Pig, Meat, eggs	
		Tobit Elasticity coefficient (t-ratio)	SURE Elasticity coefficient (t-ratio)	Tobit Elasticity coefficient (t-ratio)	SURE Elasticity Coefficient (t-ratio)	Tobit Elasticity Coefficient (t-ratio)	SURE Elasticity coefficient (t-ratio)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Urban Population (percent)	0.16* (2.56)	-0.7** (-3.11)	-0.9** (-3.11)	0.7** (3.69)	1.00** (3.46)	1.1** (7.89)	1.2** (7.26)
Small & marginal farms (percent)	0.85* (2.23)						
Male wages (Rs./day)	-0.46 (-1.04)	-1.5 (-1.64)	-3.1** (-3.75)	-4.1** (-2.8)	-3.5** (-3.09)	-0.1 (-.-7)	0.3 (0.41)
Rainfed land covered by watershed programme (percent)	0.19** (3.80)	0.4	0.0				
Agriculture term loans (Rs./ha)		(1.37)	(-0.35)				
Processing and cold storage units (numbers)		0.5** (5.93)	0.6** (6.65)	0.1 (1.71)	-0.1 (-0.77)		
Improved poultry (percent)						0.7** (3.58)	0.6** (3.32)
Number of poor (percent)	-0.09 (-1.02)	-0.7** (-2.78)	-1.0* (-2.59)	0.0 (-0.01)	0.3 (0.78)	0.2 (1.16)	0.3 (1.35)
Normal rainfall (con)		1.3 (1.65)	1.7* (2.35)*	-0.4 (-0.58)	-0.02 (-0.04)	-0.4 (-1.68)	-0.1 (-0.61)
Agricultural credit (Rs./ha) Irrigated area (percent of gross cropped area)	-	-0.6* (-2.28)	-1.0* (-2.73)	-0.3 (-1.17)	-0.2 (0.44)	-0.4 (1.68)	-0.1 (0.61)
Road density (Km/Sq. Km of geographical area)						1.2 (1.79)	1.0 (1.86)
Number of observations	20	20	20	20	20	20	20
R^2	0.58	0.49		0.70		0.83	

(Note – * and ** significant at 5 and 1 percent, respectively).

comprises 24 percent of the agricultural output in the urban urban-surrounded districts as compared to 20 percent in the hinterland districts. In the hinterland districts, commercial crops like oilseeds, pulses, course cereals and paddy account for a large share. Paddy accounts for a larger in the urban and urban-surrounded districts also, which is an indication of the fact that farmers rarely compromise their households staple foods security. Nonetheless the results Cleary reveal that compared to farmers in remote locations, the farmers in urban an peri-urban locations allocate relatively a larger share of their resources to high value perishable commodities because of their proximity to consumption centers, market infra-structure and support services.

Although a simple comparison of the values of the shares of different agricultural activities between urban and urban-surrounded and hinterland districts indicate that urbanization is an important factor in land allocation to agricultural activities, there are other factors related to agro-ecological and socio-economic environment that exert considerable influence on the choice of crops. To further probe the role of urbanization vis-à-vis other factors we estimate Tobit and SURE regression with share of high-value food commodities in the total value of agricultural production as dependent variable and urbanization together with other factors important in crop choice as explanatory variables. These regression were estimated for fruits, vegetables, monogastric meat (Poultry and pig) and for combined high-value commodities.

Table 4, presents the results of the Tobit and SURE regressions. For all high-value commodities combine together we find a significantly positive effect of urbanization on the concentration of high-value food commodities. Other variables that have a positive and significant influence on the concentration of high-value commodities are rain fed area covered under watershed programme and higher incidence of small holders. Table 4 also contains the results of the individual commodities or commodity groups. Urbanization is observed to have a significantly negative effect on the concentration of fruit production. Fruit production is positively associated with rainfall and negatively with irrigation. This is because fruits find niches in high-rainfall regions but away from districts having intensive agricultural systems under irrigation, availability of an agro-processing facility is an important factor driving fruit production. Fruit production is negatively associated with wages since its production is labour intensive. Vegetable production on the other hand is positively associated with urbanization and like for fruits negatively with farm wages. For vegetables, rainfall and irrigation do not have significant influence on their regional spread indicating that these are grown in all type of agro-climatic situations.

Poultry and pig meat production is largely driven by urbanization, infra-structure and technology. Credit is significantly negative influence on concentration of poultry and pig activity. This is somewhat surprising. One possible explanation for this could be that pig meat pig meat production is concentrated in less endowed regions, while much of the credit is directed towards better endowed region. For poultry it is the increasing incidence of contract farming arrangements with provide all critical inputs to farmers. Birthal *et. al.* (2005) found contract firms sharing as much as 90 percent of the variable cost in broiler production.

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GENETIC VARIABILITY IN DIFFERENT GENOTYPES OF ONION (*ALLIUM CEPA* L.) UNDER ALLAHABAD AGRO-CLIMATIC CONDITION

Gaurav Srivastav, V. M .Prasad, Vijay Bahadur and Balaji Vikram
Department of Horticulture,
Sam Higginbottom Institute of Agriculture, Technology and Sciences,
Allahabad- 211007. (U.P.) India.

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ABSTRACT

The present investigation was carried out in the rabi season in different genotype of onion. The investigation was laid out in RBD with three replications. There were 20 genotypes wide variation was observed among the genotypes for all traits. Results revealed that the genotype Agrifound Dark Red resulted in higher yield, better size of Bulb and stand promising for cultivation under agro-economic condition of Uttar Pradesh. The maximum heritability percent was reported for Length of Leaves and Diameter of Bulb (0.96) followed by Plant Height (0.96). High genetic advance was reported for Dry Weight of Bulb (22.77) followed by Fresh Weight of Bulb (22.65), however the maximum genetic advance as percent of mean was reported for Diameter of Bulb (49.87) and Dry Weight of Bulb (40.50). High heritability coupled with high genetic advance was observed for fresh weight and dry weight. Bulb have positive significant correlation with fresh weight and dry weight both phenotypic and genotypic level. There for these characters should be given priority cheekily during selection for genetic improvement of onion. Maximum yield of onion, gross return, net return and cost: benefit ratio (1:10.76) were obtained in the Agri Found Light Red.

Key words: *Onion, variability, heritability, correlation coefficient.*

INTRODUCTION

Onion belongs to the family *Alliaceae*, *genus Allium*and species*cepa* L. with basic chromosome number x = 8 (2n = 16). Taxonomically, it belongs to Allium section cepa (Mill.) Prokh. This section comprises nine wild species besides the cultivated A. cepa (common or bulb onion) and Allium fistulosum (bunching onion). The genus *Allium* is large genus containing 450 species, which are biennial and perennial, and all of them are bulbous. Cultivated onion is herbaceous annual for the bulb production and biennial for seed production. The flowers are bisexual which are protoandraus and cross-pollinated. The edible portion is a modified stem, botanically known as "Truncated bulb" which develops underground, and consists of vegetative stem

axis and the storage leaf bases of the outer leaves (Singh *et al.,* 2013). Conventional breeding methods such as pedigree, bulk and back cross breeding with some modifications have been principal procedures useful for improvement of bulb crops.

Onion is cultivated year round but maximum during *Rabi* season in our country. It is a photo-sensitive crop and on the basis varieties are divided into short day and long day types. Long day types are high yielder but have poor shelf life whereas short day types have better shelf life with the low yielding capacity (Sandhu *et al.,* 2015). Genetic diversity is essential to meet the diversified goals of plant breeding such as breeding for increasing yield, wider adaptation, desirable quality, pest and disease resistance. Selection of genetically diverse parents in any breeding programme is of immense importance for successful recombination breeding.

A cultivar crop performs differently under different agro-climatic conditions and various cultivars of the same species grown even in the same environment give different yields as the performance of a cultivar mainly depends on the interaction of genetic makeup and environment Mahanthesh, *et al.* (2008) conducted a field experiment to evaluate the yield performance of four onion varieties and found that some other varieties performed better than the commonly grown onion varieties by the farmers. Singh, *et al.* (2011) conducted an evaluation trial of three onion cultivars in Randomized Complete Block Design having three replications and concluded that onion cultivar performed differently and Parachinar local variety resulted in higher yield.

The development of new varieties is a long and expensive process which also needs expert scientists especially, plant breeders. The availability of seeds and the cost of seeds affect the adoption of the varieties by the farmers. When breeding for a particular set of growing conditions, it is highly important to know the use of local populations, since in them the relationships among yield components are balanced and in harmony with the effects of the specific climatic factors Singh, *et al.* (2015). The purpose of the on-station variety evaluation trials was to identify promising onion varieties and thus provide up-to-date variety recommendations for the onion growers. Before any final variety recommendation is made, it is extremely important to evaluate the varieties on farmer's field for their adaptation and productivity performance.

MATERIALS AND METHODS

The experiment was conducted in the Vegetable Research Farm, Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (Uttar Pradesh)during 2013-2014. All the facilities necessary for cultivation, including labor were made available in the department. The experiment was laid out in Randomized Block Design with 20 treatments. The treatments were replicated three times. Name of onion genotypes are Agri Found Light Red, Bhima Red, Bhima sakti, Arka kalian, N-241, Bhima Raj, Rampur, LR-241, Bhima subhra, Pusa madhavi, Arka lalima, Pusa Red, Bhima sweta, N-53, Bhima Super, Bhima Kiran, Arka Niketan, Arka Bindu, Arka pragati and Udaipur. The raised nursery beds of size 3m length, 1m breadth and 0.15 m height were prepared after bringing the soil to a fine tilth. The beds were levelled. The seeds of 8 onion genotypes were sown in lines drawn 10 cm apart on the beds on 23 octaber 2013. Before sowing nursery was

prepared and levelled by mixing well rotten F.Y.M. and soil was treated with Carbendazim (0.20%) and seed were treated with Bavistin (0.2%). Immediately after sowing water was sprinkled uniformly over the bed. Carbendazim at rate of 0.2 % and copper oxychloride at rate of 0.2 % were sprayed at weekly interval to prevent damping off. Seedlings were protected from rain, whenever needed with the help of plastic sheet. The experimental field was prepared by ploughing with a Tractor drawn disc plough followed by two cross harrowing and planking. The field was thoroughly leveled by a leveler before it was laid out. Manure and fertilizer were applied according to recommended doses for onion i.e. 25-30 t/ha. FYM or compost along with fertilizer N : P : K @ 80-125: 50-75:80-125 kg per ha^{-1}. FYM was well incorporated in plots at least 20 days before transplanting. Apply 50% nitrogen and entire dose of P_2O_5 and K_2O before transplanting or set sowing and remaining half nitrogen is top dressed 5-6 week after transplanting. Seven week old seedlings were transplanted in the experimental plots after allotting entries randomly in each replication. Before transplanting, healthy and uniform seedlings were selected and the selected seedlings were dip the roots in the solution of Bavistin @ 2g/liter to save the crop from pink rot diseases. On the day of transplanting, the field was irrigated and seedlings were transplanted. Gap filling was done seven days after transplanting. Hand weeding was done five times at 20, 40, 65, 90 and DAT. The correlation coefficient was calculated as per the method suggested by Singh and Choudhary (1977). Path coefficient analysis was done according to Miller, *et al.* (1958).

RESULTS AND DISCUSSION

The mean of the different traits for 20 genotypes of Onion (*Allium cepa L.*) have been presented in table 1. Analysis of variance showed significant differences among all 20 genotypes for 10 characters studied at 0.5% level of significance, indicating the presence of sufficient variability among genotypes. These characters were plant height (cm), Leaf length (cm), Number of leaves, Diameter of bulb (cm), Fresh weight of bulb (g), Dry weight of bulb (g), Bulb yield per plot (kg), Yield (t/ha), T.S.S.(^{0}Brix), Vitamin - C (mg/100g) are given in (Table 1). Ram *et al.* (2011) also recorded highly significant difference among the onion genotypes with respect to all the characters under studied.

Genetic components GCV, PCV, Heritability for various traits:

The data on genetic parameters for different character are given in table 2 which are described as follows: Plant height at 90DAP the estimate of genotypic coefficient of variations was moderate i.e. 7.37 and phenotypic coefficient of variations was also moderate i.e. 7.45. The estimate of heritability in broad sense of this trait was found high 0.98 % and the estimate of genetic advance mean was found high 15.04 %. The estimate of heritability in broad sense of this trait was found high 0.94 % and the estimate of genetic advance mean was found high 14.74 %. This result is similar to the finding of Singh *et al.* (2013) was showed in genotype Agrifound Light Red.

The length of leaves at 90DAP the estimate of genotypic coefficient of variations was moderate i.e. 9.97 and phenotypic coefficient of variations was also moderate i.e. 10.00. The estimate of heritability in broad sense of this trait was found high 0.99 % and the estimate of genetic advance mean was found high 20.51 %. The estimate of heritability in

broad sense of this trait was found high 0.96 % and the estimate of genetic advance mean was found high 19.68 %. This result is similar to the finding of Jat, *et al.* (2014) was showed in genotypes Agrifound Light Red.

The Leaves/ Plant at 90DAP the estimate of genotypic coefficient of variations was moderate i.e. 10.10 and phenotypic coefficient of variations was also moderate i.e. 10.17. The estimate of heritability in broad sense of this trait was found high 0.98 % and the estimate of genetic advance mean was found high 20.68 %. The estimate of heritability in broad sense of this trait was found high 0.77 % and the estimate of genetic advance mean was found high 21.13 %. Present findings are in conformity with the Singh, *et al.* (2010) and Dhotre, *et al.* (2010) was showed in genotypes Agrifound Light Red.

Diameter of bulb estimate of genotypic coefficient of variations was moderate i.e. 19.79 and phenotypic coefficient of variations was also moderate i.e. 20.14. The estimate of heritability in broad sense of this trait was found high 0.96 % and the estimate of genetic advance mean was found high 40.07%. The estimate of heritability in broad sense of this trait was found high 0.96 % and the estimate of genetic advance mean was found high 38.92 %. This result is similar to the finding of Bharti, *et al.* (2011) was showed in genotypes Agrifound Light Red followed Bhima Red.

Fresh weight of bulb estimate of genotypic coefficient of variations was moderate i.e. 12.73 and phenotypic coefficient of variations was also moderate i.e. 12.94. The estimate of heritability in broad sense of this trait was found high 0.96 % and the estimate of genetic advance mean was found high 25.80 %. The estimate of heritability in broad sense of this trait was found high 0.89 % and the estimate of genetic advance mean was found high 23.55 %. Present findings are in conformity with the Dewangan and Sahu (2014).

Dry weight of bulb estimate of genotypic coefficient of variations was moderate i.e. 17.09 and phenotypic coefficient of variations was also moderate i.e. 17.42. The estimate of heritability in broad sense of this trait was found high 0.96 % and the estimate of genetic advance mean was found high 34.56 %. The estimate of heritability in broad sense of this trait was found high 0.89 % and the estimate of genetic advance mean was found high 31.60 %. This result is similar to the finding of Ananthan and Balakrishnamoorthy (2007) was showed in genotypes Agrifound Light Red followed Bhima Red.

TSS of bulb estimate of genotypic coefficient of variations was moderate i.e. 8.27 and phenotypic coefficient of variations was also moderate i.e. 9.08. The estimate of heritability in broad sense of this trait was found high 0.82 % and the estimate of genetic advance mean was found high 15.51 %. The estimate of heritability in broad sense of this trait was found high 0.81 % and the estimate of genetic advance mean was found high 14.59 %. This result is similar to the finding of Jat, *et al.* (2014) was showed in genotypes Agrifound Light Red followed Bhima Red.

The vitamin 'C' of onion bulb estimate of genotypic coefficient of variations was moderate i.e. 6.05 and phenotypic coefficient of variations was also moderate i.e. 8.21. The estimate of heritability in broad sense of this trait was found high 0.54 % and the estimate of genetic advance mean was found high 9.20 %. The estimate of heritability in broad sense of this trait was found high 0.65 % and the estimate of genetic advance mean was found high 10.15

%. Present findings are in conformity with the Aliyu *et al.* (2007) and Hosamani, *et al.* (2010).

During the year 2013-14, the bulb yield per plot estimate of genotypic coefficient of variations was moderate i.e. 15.87 and phenotypic coefficient of variations was also moderate i.e. 19.58. The estimate of heritability in broad sense of this trait was found high 0.65 % and the estimate of genetic advance mean was found high 26.50 %. The estimate of heritability in broad sense of this trait was found high 0.67 % and the estimate of genetic advance mean was found high 26.52 %. This result is similar to the finding of Jat, *et al.* (2014) and Jat and Vikram (2016). was showed in genotypes Agrifound Light Red.

Yield t/ha estimate of genotypic coefficient of variations was moderate i.e. 16.66 and phenotypic coefficient of variations was also moderate i.e. 17.75. The estimate of heritability in broad sense of this trait was found high 0.88 % and the estimate of genetic advance mean was found high 32.22 %. The estimate of heritability in broad sense of this trait was found high 0.82 % and the estimate of genetic advance mean was found high 29.90 %. This result is similar to the finding of Asohk and Pal (2013) and Jat, *et al.* (2014) were showed in genotypes Agrifound Light Red.

The phenotypic coefficient of variability (PCV) was much larger than genotypic coefficient of variances (GCV) for all characters, indicating that all the characters under study are influenced to various degrees by the environmental factors. PCV is higher than the GCV for all the traits. Medium genotypic and phenotypic coefficient of variation is observed for biomass yield per plot, fresh weight of bulb and bulb yield per plot whereas low genotypic and phenotypic coefficient of variance is observed for plant height, leaf height, number of leaves and bulb diameter.Highest GCV and PCV were recorded for bulb yield per plot. Present findings are in conformity with the Haydar, *et al.* (2007); Jat and Vikram (2016).

In the present study it is observed that the difference between GCV and PCV for most of the characters is narrow. Thus reflecting that the existing variability can be utilized in onion breeding programmers.

Higher heritability associated with high genetic advance for number of fruit/ plant, TSS (^{o}Brix) contents and yield/ plant. All the characters under study showed high heritability. The result is similar to the findings of Mohanty (2002). High heritability coupled with higher genetic advance for all the characters and GCV, PCV were high for number of leaves per plant. TSS, Number of fruits / plant, total and yield/hectare. The result is similar to the findings of Chattoo *et al.* (2015) and Ullah, *et al.* (2005). The extent of progress that could be achieved in any crop depends on the primary raw material, the variability existing in the base material. In the absence of which there shall be no response to selection. The phenotypic coefficient of variability (PCV) was much larger than genotypic coefficient of variances (GCV) for all characters, indicating that all the characters under study are influenced to various degrees by the environmental factors. On the basis of presence performance for different characters genotype Pusa Madhavi was found superior in terms of bulb yield per hectare. Large amount of variability was observed in the experimental for selection. Characters like plant height, leaf height, leaves per plant, diameter of bulb, fresh weight of bulb, dry weight of bulb, bulb yield per plot high and heritability coupled with high to moderate genetic advance.

Table.1 Mean performance of different genotypes various characters.

S.N.	Source of variation / characters	Mean sum of squares		
		Replication D.f=2	Treatments D.f=6	Error D.f=12
01	Plant height (cm) 30 DAT	1.34	18.91**	2.89
02	Plant height (cm) 60 DAT	56.83	63.63*	18.75
03	Plant height (cm) 90 DAT	3.18	35.22*	11.69
04	Leaf height (cm) 30 DAT	1.52	14.31*	3.41
05	Leaf height (cm) 60 DAT	44.45	44.38*	11.65
06	Leaf height (cm) 90 DAT	4.38	50.79**	8.33
07	Leaves per plant 30 DAT	0.00	0.31**	0.05
08	Leaves per plant 60 DAT	0.08	0.38**	0.07
09	Leaves per plant 90 DAT	0.48	2.93*	0.70
10	Bulb diameter (cm)	0.31	4.05**	0.74
11	Fresh weight of bulb (g)	1222.78*	2196.43**	255.69
12	Dry weight of bulb (g)	482.28	1998.49**	304.56
13	TSS (^{o}Brix)	0.84*	1.24**	0.18
14	Vitamin ‘c’ (100gm/mg)	0.28	0.53	0.26
15	Bulb yield per plot (kg)	0.63	2.07**	0.40
16	Bulb yield (t/ha)	28.26	92.21**	17.98

Table. 2 Coefficient of variation, genetic variability heritability, genetic advance and genetic advance as percent on mean for 20 traits in onion genotypes

Character	GCV	PCV	h^2 (bs)(%)	GA as percent on mean		GV	PV	GA	
	2013-2014	2013-2014	2013-2014	2013-2014		2013-2014	2013-2014	2013-2014	
				5%	1%			5%	1%
Plant Height (cm) 90 DAT	7.37	7.45	0.98	15.04	19.27	19.02	19.41	8.89	11.39
Length of Leaves (cm) 90 DAT	9.97	10.00	0.99	20.51	26.28	26.24	26.35	10.53	13.49
Leaves/ Plant 90 DAT	10.10	10.17	0.98	20.68	26.50	1.18	1.20	2.23	2.85
Diameter of Bulb (cm)	19.79	20.14	0.96	40.07	51.36	1.20	1.24	2.22	2.84
Fresh Weight of Bulb(g)	12.73	12.94	0.96	25.80	33.07	84.08	86.91	18.58	23.81
Dry Weight of Bulb (g)	17.09	17.42	0.96	34.56	44.29	84.71	87.95	18.60	23.84
TSS (Brix)	8.27	9.08	0.82	15.51	19.88	0.95	1.15	1.83	2.35
Vit. C (100gm /Mg)	6.05	8.21	0.54	9.20	11.79	0.44	0.82	1.01	1.30
Bulb Yield/ Plot (kg)	15.87	19.58	0.65	26.50	33.96	0.73	1.11	1.42	1.82
Yield t/ha	16.66	17.75	0.88	32.22	41.29	17.55	19.93	8.10	10.38

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EFFICACY OF INSECTICIDES AGAINST POD BORER (*HELICOVERPA ARMIGERA*) IN PIGEONPEA

Ravi Prakash Maurya and Ajay Singh
N.D. University of Agril. & Tech. Kumarganj, Faizabad. (U.P.), India

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ABSTRACT

Pigeon pea is one of the most important pulse crops cultivated in U.P. It is one of the most important pulse crops cultivated in U.P. To find out economic and effective insecticide against the pod borer (*Helicoverpa armigera*) infesting insect pest on pigeon pea, The pigeon pea variety, Narendra Arhar-1, an experiment was laid out in randomized block design(RBD) with 7 treatments including control and 3 replications at the instructional farm of Narendra Deva University of Agriculture and Technology, Kumarganj Faizabad (U.P.). Every treatment in each replication was assigned a plot size of 21m. The pigeon pea variety, Narendra Arhar-1, was sown with recommended practices. Six insecticides vize. Acetamiprid 20 WP, Indoxacarb14.5 SL, Imidaclropid 17.8 EC, Dimethoate 30 EC, Cartap Hydrochloride 75 SG and Fipronil 5 SC were evaluated in the field against pod borer in pigeon pea. The plot treated with Indaxacarb 14.5 SL provided superiority over insecticides which resulted the maximum mortality of pod borer with higher yield (22.33 Q/ h), However, remaining insecticides were also found significantly superior over the control.

Key words: *Insecticides, cajanus cajan, helicoverpa armigera*

INTRODUCTION

Pigeon pea is a crop of indeterminate plant type with long duration. Hence, serves as an ideal host plant of several insect pests. Around two hundred insects causing varying degree of infestation right from the day of sowing until storage have been reported to invade pigeon pea. One of the major insect – pests which was observed from initiation of flowering till maturity of the crop was pod borer. In India, it is one of the most important pulse crops cultivated in U.P. It occupied about 3.44 lakh ha area with a production of 3.08 lakh mt and productivity 8.96 q/ha (Anonymous, 2013).

The pod borers complex include *Maruca testu* (Geyer), *Helicoverpa armigera* (Hubner), *Adisura atkinsoni* (Moore), *Etiella zinckenella* (Treitschke), *Cydia ptychora* (Meyrick), *Exelastis atomosa* (Walsingham)

and *Lampides boeticus* (Cinnaeus). Farmers rely only on synthetic insecticides to manage these insect pests leading to increased risk of environmental contamination, loss of biodiversity and insecticides induced resurgence and resistance in insect pests (Rao and Reddy, 2003). In recent years, Integrated Pest Management (IPM) is the only key strategy to reduce the load toxic chemical pesticide in the environment. Keeping these in view, the present investigations were carried out to evaluate the IPM module against the pest of pigeon pea under ICAR-AICRP (Pigeon pea programme).

Although a number of insect pests causing considerable of loss to pigeon pea have been reported, yet no-adequate information on the incidence population build up and extent of damage caused by *H. armigera* and their natural enemies is available in Eastern plain zone and in Vindhyan zone of Eastern Uttar Pradesh. Keeping in view of aforesaid facts and knowing the seriousness of problem, the study was conducted with the objective to find out effective and economical management of pod borer.

Ghanshyam (2004) found that Imidacloprid 200 SL 0.0025% registered maximum reduction of larval population and pod damage i.e. 84.75, 1.33% respectively and found superior from rest of the treatments had also Imidacloprid 200 SL 0.004 per cent and its lower dose 0.0025 per cent registered minimum pod infestation. Patil *et al.* (1990) applied quinalphas, endosulfan, methyl parathion, methamidophos and fenvalerate against *H. armigera*, E. atomosa and M. obtusa on pigeon pea and reported that fenvalerate (0.01%) treated plots had the least pod damage and produced highest grain yield followed by Methamidophos 0.12% and endosulfan (0.07%).

Rai (1991) evaluated the efficacy of several insecticides against *H. armigera, E. atomosa, M. obtusa* and *C. gibbosa* on pigeonpea and reported the endosulfan and phosphamidon were the most effective insecticides during the both seasons. Singh *et al.* (2001) applied endosulfan 0.07% fenvalerate 0.02% monocrotophos 0.04, dimethoate 0.03%, quinalphas 0.05%, NSKE 5% twice at pod initiation and 50% podding stage of pigeon pea against *M. obtusa* and pod borer complex and reported that the lowest pod damage of 2.4% in the plots treated with fenvalerate as compared untreated plots which a damage pods were recorded the effective insecticides against pod borers was the monocrotophos followed by fenvalerate and endosulfan similarly pod fly was best controlled by fenvalerate followed by monocrotophos and dimethoate.

Baruah *et al.* (2002) evaluated the efficacy of cypermethrin, deltamethrin, fenvalerate, along with endosulfan and recorded highest and significantly more average yield of 28.06q/ha in cypermethrin treated plots.

MATERIALS AND METHODS

In order to find out economic and effective insecticide against the pod borer (*Helicoverpa armigera*) infesting insect pest on pigeon pea, an experiment was laid out in randomized block design(RBD) with 7 treatments including control and 3 replications at the instructional farm of Narendra Deva University of Agriculture and Technology, Kumarganj Faizabad (U.P.). Every treatment in each replication was assigned a plot size of 21m. The pigeon pea variety, Narendra Arhar-1, was sown on the 17 July 2012 and all the recommended practices were followed to grow

a good crop Buffer area of 2.0 and 1.0 meter was left between the replication and plots, respectively, to serve as path and also to avoid the drift of insecticides during application the details of the insecticidal treatment used in experiment. The measured amount of each insecticide was dissolved in desired amount of water and sprayed with hand operated high volume pneumatic knap-sack sprayer fitted with flat cone nozzle. The spray of insecticides was done as and when 5 per cent pod infestation was noticed. The observations regarding pest population were collected.

RESULTS AND DISCUSSION

The pod borer infestation was observed at pod formation stage. First application of insecticide was done, when damage caused by borer, reached at ETL (5 percent infested pods). Effect of various treatments in different plots, doses and pretreatment was done at 3, 7 and 15 DAS. The results of the two sprays are presented in Table 1.

Table: 1 Effect of various treatments on pod damage (%) caused by pod borer on pigeon pea var NDA-1 during 2012-13

No of plots	Insecticides	Dose	Pre – treat ment	1st Spray			2nd Spray		
				3 DAS	7 DAS	15 DAS	3 DAS	7 DAS	15 DAS
T1	Acetamiprid 20 WP	0.015%	5.30	2.40	2.90	3.33	1.80	2.00	1.50
T2	Indoxacarb 14.5 SL	0.015%	5.10	1.40	1.60	3.40	1.20	0.80	1.00
T3	Imidaclropid 17.8 EC	0.008%	5.00	1.90	2.00	2.90	1.60	1.95	1.10
T4	Dimethoate 30 EC	0.03%	5.80	2.40	2.60	3.40	1.30	1.65	1.06
T5	Cartap Hydrochloride 75 SG	0.038%	5.40	2.66	2.80	3.66	1.75	1.87	1.20
T6	Fipronil 5 SC	0.003%	5.20	3.00	3.20	4.00	1.85	1.96	1.40
T7	Un treated	-------	5.40	11.66	13.70	14.70	12.30	13.40	15.30
SE (M)			0.44	0.21	0.18	0.20	0.24	0.15	0.26
C D 5%			1.38	0.66	0.57	0.64	0.75	0.47	0.80

As the table revealed that during the kharif 2012-13, the observation pod damage among all treatments were non significant before application of insecticide which range from 5.80 percent pod damage at 3 days after treatment of insecticide, the pod borer and infestation varied from 1,40 to 11.66 percent pod damage . All the treatments were found effective and significantly superior over control. The minimum pod damage was recorded as 1.40 in Indoxacarb 14.SL treated plots which was significantly superior over

days varied from 2.90 to 14.70 percent. The infestation caused by pod borer were at ETL after 15 days application of insecticide, therefore, second application was done to check the infestation of pod borers. The minimum incident of pod infestation (2.90) was observed in the Imidaclorpid 17.8 SL. The infestation reduced to 1.10 percent at the 2nd spray to treated plots followed by Acetamiprid 20 WP that recorded 3.33 percent on 1st spray which reduced to 1.50 percent on 2nd spray, Dimethoate 30 EC (3.40 on 1st spray to 1.06 percent on 2nd spray, while the infestation reduction was from 3.40 1.00 in the Indoxacarb 14.5 SL treated plot. In the Fipronil 5 SC treated plot the infestation at 15DAS was 4.00 which reduced to 1.40 percent on its 2nd spray, while change found from 1st to 2nd spray in Cartap hydrochloride 75 SG plot was 3.66 to 1.10 percent . It was interesting to note that the infestation of pod borer in the Indoxacarb 14.5 SL and Dimethoate treated plots were found to be same on 1st spray but on 2nd spray the infestation was 1.00 percent and 1.06 percent respectively.

Three replications were administered with each insecticides and its effect of various treatments on grain yield of pigeon pea at different replication is presented in Table 2.

The mean of the replication revealed that effective treatments in order of their superiotes were - Indoxacrab 14.5 SL at 0.015% concentration yielded 22.33 q/ha, Dimethoate 30 EC at 0.03% 21.75q/ha), Imidaclorpid 17.8EC at 0.008% production was 20.5q/ha, Cartap Hydrochloride 75 SG at 0.038% yielded 19.7q/ha and Fipronil 5 SC at 0.003% production 18.35q/ha. It was evident from the data under study did not differ significantly with each other. The least effective treatment was Acetamidrid 20 WP at 0.015% as the yield was just 17.53 q/ha but it was better than the untreated plot (control) as the grain

Table 2: Effect of various treatments on grain yield (Q/ha.)of pigeon pea variety NDA-1 at different replication

Total plots	Insecticides	Concentration	Grain yield (Q/ha.)				
			R1	R2	R3	Total	Mean
T1	Acetamiprid 20WP	0.015%	17.50	17.80	17.30	52.6	17.53
T2	Indoxacarb 14.5 SL	0.015%	22.20	22.00	22.80	67.00	22.33
T3	Imidaclorpid 17.8EC	0.008%	20.30	20.85	20.40	61.55	20.5
T4	Dimethoate 30EC	0.03%	21.60	21.90	21.75	65.25	21.75
T5	Cartap Hydrochloride 75SG	0.038%	19.80	19.65	19.70	59.15	19.70
T6	Fipronil 5SC	0.003%	18.40	18.65	18.00	55.05	18.35
T7	Untreated control	--------	14.20	14.80	14.45	43.45	14.48
SE (m)							0.60
C D at 5%							1.85

yield 14.48 q/ha. The critical difference at 5% for the treatments was found significantly based on grain yield.

SUMMARY AND CONCLUSION

Thus, all the tested treatments were effective and significantly superior over the untreated check. Most effective treatment was Indoxacarb 14.5 SL at 0.015%, followed by Dimethoate 30 EC at 0.03% in which larval 1.00 and 1.20 per cent recorded. Acetamiprid 20WP 0.015% was least effective and larval 1.50% recorded. As regards yield most effective treatment was Indoxacarb 14.5 SL at 0.015% ha followed by Dimethoate 30 EC at 0.03% in which 22.33 and 21.75q/ha respectively healthy grains were recorded. Efforts are needed to promote the most effective treatments namely Indoxacarb 14.5 SL at 0.015% for enhancing production of pigeon pea in U.P.

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EFFECT OF STRATIFICATION DURATION AND HORMONE CONCENTRATION FOR SEED TREATMENT ON SEED GERMINATION, RATE OF SEED GERMINATION, TRANSPLANTING SUCCESS AND SEEDLING MORTALITY IN AONLA *(EMBLICA OFFICINALIS,* GAERTN.)

Hemlata Pant* , Surya Narayan and Manoj Kumar Singh****

*Society of Biological Sciences and Rural Development, Allahabad - 211019, (U.P.), India

**Department of Horticulture, K.A.P.G., Collage Allahabad -, 211001, (U.P.), India

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ABSTRACT

The experiment was conducted at the Department of Horticulture, Kulbhasker Ashram Post Graduate Collage, Allahabad, Uttar Pradesh with a view to standardize suitable stratification duration and hormone concentration for Aonla seed treatment. There were seven treatment combinations (T_1 to T_{10}) including a control. Different duration of seed stratification i.e., 24hours,48 hours and 72hours were tried along with the 100ppm,200ppm and 300 ppm GA_3 seed treatment . Treated seeds were sown in the polythene bags (25x15 cm size, 200gauge thick) containing soil, sand and FYM mixture (1:1:1). It was interesting to note that the effect of stratification duration and hormone treatment concentration was found to be significant for seed germination, transplanting success, seedling mortality percentage and rate of seed germination. Treatment T_6 (48hrs+300ppmGA3) yielded highest percentage, (84.00) of seed germination while the lowest percentage value (37.25) was recorded in T_9 (72hrs+300ppmGA3) treatment and the transplanting success was also lowest in T_9. The seedling mortality percentage was maximum (79.25) with T_9 where as lowest percentage value (22.00) was observed for T_6 treatment. It may be concluded that T_6 treatment can be recommended for the better stand establishment of Aonla nursery.

Keywords: *Stratification, treatment, ga_3, nursery, aonla, mortality, seedling, germination, seed.*

INTRODUCTION

Increased demand of aonla *(Emblica officinalis,* Garten.) buddlings in traditional as well as nontraditional areas of India due to its peculiar character of diverse use, medicinal value ,tolerance to biotic and abiotic stresses ,higher benefit cost ratio and positive government policies emphasized to chalk out some feasible and acceptable measures for the better stand-establishment of saplings at the nursery stage. Aonla buddlings are prepared thorough budding on seedling root - stock which is obtained through seeds. In nature, aonla seed has poor germination and higher seedling mortality, owing to adverse edaphic conditions during nursery stage. Therefore it becomes imperative to standardize suitable stratification time and exact hormone concentration for seed treatment for flourishing the aonla nursery-industry. Certainly, these tactics are the most important component to provide sound base for propagation, once time

and concentration is standardize, we shall be able to grow healthy seedlings with faster rate.

Keeping these aspects in view, the experiment was under taken to ascertain the effect of the stratification and hormone treatment on seed germination, rate of seed germination, transplanting success and mortality of seedlings.

MATERIALS AND METHOD

The experiment was conducted at the Department of Horticulture, Kulbhasker Ashram Post Graduate Collage, Allahabad, Uttar Pradesh during the year 2012-13 with a view to standardize suitable stratification duration and hormone concentration for Aonla seed treatment. There were ten treatment combinations (T_1 to T_{10}) including a control. Different duration of seed stratification i.e., 24hours, 48 hours and 72hours were tried. Soaked seed were put in layers under different strata of moist sand for varying duration. GA_3 hormone @ 100ppm, 200ppm and 300 ppm was used for seed treatment after stratification. Treated seeds were sown in the polythene bags (25x15 cm size, 200gauge thick) containing soil, sand and FYM mixture (1:1:1).

RESULTS AND DISCUSSION

Seed germination in aonla started after 3 days of seed sowing and completed within 27 days in all the treatment. Seed germination under different treatments ranged between 37.25 to 84.00 percent. The percentage of seed germination as influenced by treatments differed significantly The maximum seed

Table: 1 Effect of stratification durationand hormone concentration on seed germination and rate of seed germination in Aonla *(Emhlica officinalis*, GAERTN.)

Treatments	Seed germination (%)								*Rate of seed germination*
	3 DAS	6 DAS	9 DAS	12 DAS	15 DAS	18 DAS	21 DAS	27 DAS	*Mean days taken in seed germination*
T_1 (24hrs+100ppmGA3)	2.95 (9.89)	22.66 (23.29)		48.33 (37.06)	53.66 (40.92)	56.00 (45.12)	56.00 (45.12)	56.00 (45.12)	10.43
T_2 (24hrs+200ppmGA3)	3.05 (10.3)	22.66 (25.29)		50.33 (40.06)	58.66 (45.92)	60.00 (50.12)	60.00 (50.12)	60.00 (50.12)	10.25
T_3 (24hrs+300ppmGA3)	3.25 (10.30)	24.66 (28.29)	47.33 (40.4)	53.33 (45.06)	60.66 (48.92)	61.00 (52.12)	61.00 (52.12)	61.00 (52.12)	10.01
T_4 (48hrs+100ppmGA3)	2.36 (8.83)	25.66 (30.29)	49.33 (44.4)	55.33 (48.06)	63.66 (52.92)	64.00 (53.12)	64.00 (53.12)	64.00 (53.12)	11.40
T_5 (48hrs+200ppmGA3)	3.60 (10.82)	25.66 (30.33)	51.33 (45.76)	61.66 (51.75)		65.00 (53.72)	65.00 (53.72)	65.00 (53.72)	11.24
T_6 (48hrs+300ppmGA3)	5.63 (13.55)	27.66 (31.64)	57.66 (49.41)	64.00 (51.13)	83.33 (68.91)	84.00 (69.35)	84.00 (69.35)	84.00 (69.35)	11.03
T_7 (72hrs+100ppmGA3)	2.63 (10.75)	24.53 (33.21)	39.85 (39.44)	42.25 (41.44)	44.25 (42.44)	44.25 (42.44)	45.49 (43.21)	45.49 (43.21)	9.24
T_8 (72hrs+2 00ppmGA3)	2.33 (6.75)	23.53 (30.21)	39.25 (38.44)	40.25 (39.44)	41.25 (40.44)	41.25 (40.44)	41.25 (40.44)	41.25 (42.44)	9.01
T_9 (72hrs+3 00ppmGA3)	2.23 (5.75)	22.53 (28.21)	37.25 (37.44)	37.25 (37.44)	37.25 (37.44)	37.25 (37.44)	37.25 (37.44)	37.25 (37.44)	8.25
T_{10} (control)	2.53 (8.75)	20.53 (23.21)	33.25 (32.44)	43.12 (39.21)	48.00 (41.04)	49.54 (42.32)	50.74() (43.49)	50.74 (43.49)	15.52
C.D. at 5%		3.24	3.11	2.89	2.75	3.01	3.01	3.01	2.36

Note: figures in parentheses are average transformed value.

Table: 2 Effect of stratification duration and hormone concentration on seedling mortality and transplanting success in Aonla *(Emhlica officinalis,* GAERTN.)

Treatments	*Seedling mortality (%)*					*Transplanting success (%)*
	28 DAS	35 DAS	42 DAS	49 DAS	56 DAS	
T_1 (24hrs+100ppmGA3)	12.00 (22.30)	23.09 (32.04)	28.93 (34.91)	35.01 (38.03)	35.01 (38.03)	74.43
T_2 (24hrs+200ppmGA3)	11.00 (21.30)	21.09 (30.04)	26.93 (32.91)	30.91 (34.03)	30.01 (34.03)	75.25
T_3 (24hrs+300ppmGA3)	10.99 (21.10)	20.89 (29.94)	26.63 (32.81)	30.01 (33.93)	30.01 (33.93)	76.01
T_4 (48hrs+100ppmGA3)	8.99 (20.10)	19.99 (29.64)	25.66 (31.41)	29.00 (33.13)	29.00 (33.13)	79.40
T_5 (48hrs+200ppmGA3)	8.63 (19.55)	19.66 (28.64)	24.66 (30.41)	26.00 (32.13)	28.00 (32.13)	81.24
T_6 (48hrs+300ppmGA3)	7.63 (15.55)	17.66 (24.64)	20.66 (27.41)	22.00 (28.13)	22.00 (28.13)	91.03
T_7 (72hrs+100ppmGA3)	45.63 (39.75)	48.53 (40.21)	50.85 (43.44)	58.25 (52.44)	58.25 (52.44)	49.24
T_8 (72hrs+2 00ppmGA3)	58.33 (51.75)	62.53 (55.21)	65.25 (57.44)	68.25 (58.44)	68.25 (58.44)	39.01
T_9 (72hrs+3 00ppmGA3)	62.23 (55.75)	69.53 (58.21)	77.25 (62.44)	79.25 (65.44)	79.25 (65.44)	35.25
T_{10} (control)	46.63 (39.95)	49.53 (41.21)	51.85 (44.44)	59.25 (53.44)	59.25 (53.44)	65.52
C.D. at 5%	2.31	3.54	3.42	3.89	2.95	4.43

Note: figures in parentheses are average transformed value.

germination (84.00 %) was recorded in treatment T_6 (48 hrs stratification+300 ppm GA_3) which was significantly superior to all other treatments and the value was lowest (37.25%) in T_9 (72 hrs stratification+300 ppm GA_3). The findings of the study supported and corroborated the findings of Bisla *et al., (1984)* in Ber and Govind and Chandra, (1993) in Khasi Mandrin. The lowest percentage of seed germination obtained with treatment T9 indicated adverse effect of longer duration of stratification coupled with toxic concentration GA3 which augmented seed decay and partial damage of seed too. Over tendering of seed coat and ultra concentration of GA3 might be corroded the plume and radicle of the seed resulting failure of germination. The possibility of exo-osmosismay not be denied. Dewey, (1960); Paliwal & Gandhi (1968) and Ayers and Westcot (1976) also observed the same causes.

There was insignificant difference on the rate of aonla seed germination as it was conspicuously influenced by various duration of stratification and seed treatment. However,

the faster rate of seed germination was recorded in T9 (72 hrs stratification+300 ppm GA3) i.e.8.25 mean days followed by T8 (72 hrs stratification+2ppm GA3) i.e.,9.01 mean days). The slowest rate of seed germination was recorded T10 (control) i.e., 15.52 mean days). Similar result were also recorded by Bahuguna and Pyarelal, (1993) in case of *Acacia*. There was a noticeable and significant effect of treaments on transplanting success. *All* those treatments respond poor in seed germination also were poor in transplanting success. Though seeds were sown in polythene bags and gently transplanted into the field.

The differences due to various treatments in respect of seedling mortality differed significantly The mortality of aonla seedling range between 22.00 to 79.25 per cent within 56 days of seed sowing.The highest mortality was recorded (79.25%) in T_9 (72 hrs stratification+300 ppm GA_3).followed by 68.25 per cent in T_8 (72 hrs stratification+200 ppm $GA_{3)}$ and the value was lowest (22.00%) in T_6 (48 hrs stratification+300 ppm $GA_{3)}$ treatment. Similar results were also found by Awang and Hamzah (1986) in *Acacia*. Aonla seed soaking more than 48 houres was proved detrimental in terme of seed germination and mortality Therefore soaking hours should not constitute more than 48 hours to achieve better survival of aonla seedlings. Obviously, more leaching had toxic effect of hormone on tender seedlings and higher osmotic pressure, imbalanced nutrient level lead to mortality of the seedlings The findings are in the conformity of the findings of the Sharma *et al.,* (1984) and Gupta,(1989).

Based on the result obtained from investigation it can be concluded that seed soaking for 48 hours followed by 300 ppm seed treatment with GA_3 resulted best performance with regards to percent seed germination (84.00%) and least seedling mortality (22.00%).

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following Dahanukar et spelling al. 2004, Karmarkar et al. 2012, Mishra et al. 2013 and Ghatge et spelling al. 2013. Another more recent publication by Dahanukar et al. 2011, Katwate et spelling al. 2012a, Katwate et spelling al. 2015, Katwate et spelling al. 2013a, Katwate et spelling al. 2013b, Katwate et spelling al. 2014a, Katwate et spelling al. 2014b Katwate et al. 2015, etc. were refereed to come up with a updated list of endemic fish species of Maharashtra State.

STUDY AREA

The present study focuses on the state of Maharashtra (15°35'-22°02'N and 72°36'-80°54'E) located in North Western part of peninsular India. The state encompasses three distinct physiographical regions, viz. (1) approximately 80 km wide strip of land between the Western Ghats and coastal line (Konkan), (2) 720 km of Western Ghats hill region running parallel to the coastline and (3) the eastern plateau drained by the rivers and dotted with thousands of small reservoirs. Maharashtra (with 9.36% of the total geographic area of the country) is the third largest State in terms of area (307,713Km²), blessed with vast freshwater resources; comprising 3.39 lakh ha of inland water bodies (SoERu 2007) and 380 rivers draining 19,760 km (SoER, 2007).

FISH DIVERSITY OF MAHARASHTRA

Maharashtra state has been blessed with rich ichthyofaunal spelling diversity by virtue of congregation of different types of topographical, agroclimatic and hydrodynamical spelling conditions within the state boundaries, the first effort was made by Kulkarni and Ranade 1975 to document the fish diversity of Maharashtra state as a whole listing 167 freshwater fish species. Karmarkar et spelling al. 2012 have enumerated the freshwater fish fauna of Maharashtra comprising 182 species belonging to 11 orders, 32 families, 93 genera. But a thorough estimate of Maharashtra itself is yet to be worked out and this information deficiency on the diversity and distribution of freshwater fishes, (Acharya&Iftekhar spelling, 2000; Molur et al. spelling 2011; Jadhav et spelling al., 2011) obscure the understanding of the true patterns in fish diversity (Molur et spelling al. 2011) and becomes a hurdle in designing and implementing conservation strategies (Jadhav et al. 2011).

The review of literature suggests that the Northern parts of western Ghats situated at the western border of Maharashtra and tributaries of the west flowing rivers Godavari and Krishna these rivers are not west flowing but east flowing have not been surveyed extensively or in some cases have not been explored at all and checklists for individual rivers are not available (Jadhav et al., 2011, Molur et spelling al. 2011).

ANTHROPOGENIC DEVELOPMENT AND AQUATIC HABITAT LOSS

Maharashtra, the second largest state in terms of population size (115.2 million), the third most urbanised state with an urban population of 45.23% (GOI Census, 2011), is one of the most industrialised state in the country (SOER? explain, 2007), where anthropogenic activities (predominantly, industrialisation and urbanisation) have been identified as major factor to affect the water quality of major rivers in the state (Environment monitor, 2006). Of the 30 river basins in world prioritised for the protection of aquatic biodiversity by Groombridge and Jenkins (1998), Rivers Godavari and Krishna originate in Maharashtra and Rivers Narmada & Tapti flow from the northern border of the state. Maharashtra also

EFFECTS OF MICROBIAL AND CHEMICAL FERTILIZERS ON VEGETATIVE AND REPRODUCTIVE CHARACTERISTICS OF SHIMLA MIRCH (CAPSICUM SP. LINN) CV. GIANT BULLNOSE.

Surya Narayan

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

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ABSTRACT

To study the influence of organic and inorganic fertilizers on quality and yield components in mirch this trial was carried out. In boosting the productivity potential of plant, combined application of microbial and chemical fertilizers showed 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 were recorded. Maximum plant height (60.23 cm) was observed in Treatment-5 containing NPK (+ Phosphobacteria (each 10g / pot). Similarly, the maximum number of flowers (32.25/ plant), the maximum number of fruits (13.33/plant), the highest number of branches (23.25/ plant), highest fruit weight (112.23g) and maximum total number of leaf (175.33 / plant) were also observed in treatment 5. 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: *Nutrition DAP, NPK, Urea Azospirillum, Phosphobacteria, chemical fertilizers and Shimla mirch.*

INTRODUCTION

Shimla mirch (*Capsicum sp. Linn.*) is now become a noblemen's vegetables. Its presence in the meal reflects the richness of the family. It is well responsive to nutrition and found to have great variability with varieties and soil fertility. It is a climate choosy crop and specially prefers temperate climate. Now varieties are available which successfully can be grown subtropical and tropical climate too. It's voracious feeder crop therefore fertility 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.

capable of mobilizing potash to plants in all types of soil especially low K+ content soil. Such bacterial population in the soil can ...

Wange and Kale (2004) reported that, the results 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 morpho-physiological traits in shimla mirch is meager. Hence, there is a need to study the influence of organic and inorganic on quality and yield components in shimla mirch to boost the productivity potential.

Table 2: The effect of microbial and chemical fertilizer on reproductive characteristics of Shimla mirch plant cv. Giant Bullnose.

Treatments	Days to 50% flowering time (DAP)	Flowers/plant (no)	Fruit setting/plant (no)	[illegible] /plant (kg)	Fruit weight (g)	Fruit yield/plant (kg)	Fruit yield (Q/ha)
T_1	71.11	16.01	8.21	5.12	50.21	0.300	130.25
T_2	73.33	18.41	10.24	9.01	72.25	0.658	132.22
T_3	72.12	17.01	[illegible]	8.11	60.22	0.480	131.02
T_4	67.21	28.01	19.10	[illegible]	80.20	1.050	232.36
T_5	66.23	32.25	22.25	13.33	112.23	1.540	[illegible]
T_6	67.51	29.41	20.00	10.00	104.01	1.120	191.25
T_7	76.44	26.00	5.25	4.33	85.23	0.330	135.36
T_8	79.25	27.02	6.23	5.23	90.25	0.450	138.44
T_9	77.21	25.22	3.89	4.65	26.56	0.210	136.25
T_{10}	57.23	11.64	3.54	1.65	16.85	0.099	025.68
MSE±	9.25	3.22	3.14	1.02	4.36	0.120	33.36