Vol. 17 July - December, 2022 No. 2

ABSTRACTED IN CABI, U.K., SHIMAGO, CROSS REF, INDIAN CITATION INDEX AND GOOGLE SCHOLAR, PUBLONS, CITEFACTOR

Journal of Natural Resource And Development

(Peer Reviewed, Refereed Research Journal of Agriculture and Science)

Abbreviated title of Journal : *Jour. Nat. Res. Dev.*

NAAS RATING : 3.77

online @ www.sbsrd.org

SOCIETY OF BIOLOGICAL SCIENCES AND RURAL DEVELOPMENT
10/96, Gola Bazar, New Jhusi, Prayagraj - 211 019 (U.P.), INDIA

EDITORIAL BOARD MEMBERS

REVIEWER COMMITTEE

Note : The above members are not salaried from this organization

Vol. 17 July - December, 2022 No. 2

SOCIETY OF BIOLOGICAL SCIENCES AND RURAL DEVELOPMENT

CONTENTS

Vol. 17 July - December, 2022 No. 2

SOCIETY OF BIOLOGICAL SCIENCES AND RURAL DEVELOPMENT

CONTENTS

Journal of Natural Resource and Development 17 (2) 1-7, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

IMPACT OF VERMICOMPOST WITH BIO-FERTILIZERS ON DIFFERENT TRAITS OF TUBEROSE (POLIANTHES TUBEROSA LINN.) CV. PRAJWAL

Jaspreet Kaur, Vijai Kumar, Niraj Kumar and Munendra Gangwar
Department of Horticulture
Ch. Chhotu Ram (P.G.) College, Muzaffarnagar, (U.P.), India
Corresponding Author E-mail : jaspreet.kaur7707@gmail.com

Received : 10.04.2021 Accepted : 15.05.2021

ABSTRACT

An experiment on tuberose variety 'Prajwal' was laid out at department of Horticulture, C.C.R. (P.G.) College, Muzaffarnagar (western U.P.) to study the impact of vermicompost with bio-fertilizers on different traits of tuberose (*Polianthes tuberosa Linn.*)" cv. Prajwal, from August 2020 to February 2021. The experiment was conducted in Randomized Block Design with eight treatment and three replications. The treatments were T_1 (Control), T_2 (R.D.F.), T_3 (50% R.D.F.+ 50% Vermicompost), T_4 (75% R.D.F. + 25% Vermicompost), T_5 (75% R.D.F.+ 25%Vermicompost + Azospirillum), T_6 (75% R.D.F. + 25%Vermicompost + P.S.B.), T_7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.), T_8 (50% R.D.F. + 50% Vermicompost + Azospirillum + P.S.B). Application of combine organic amendments and fertilizer showed significant variations on various aspects of the cultivar. Recorded observations indicated that T_7 exhibited better result in vegetative growth with time taken for sprouting of bulbs (12.93 days), plant height (65.27cm), leaves per plant (28.93) and higher leaf area (1507.43cm^2). While during study of floral characteristics, it was recorded that minimum days were taken to spike emergence (75.47days), maximum no. of spikes per plant (3.30), length of spike (98.37cm), length of rachis (33.37cm), no. of florets per spike (51.20), diameter of the floret (4.81cm), flower duration (19.21days) were also higher with the use of 75% R.D.F. +25% Vermicompost + Azospirillum + P.S.B.

Keywords : *Tuberose, prajwal, biofertilizer, phosphate solubilizing bacteria.*

INTRODUCTION

Tuberose, is commonly known as "Rajanigandha or Nishiganda" in India. It is a bulbous crop, originated in Mexico, spread during the 16th century to different parts of world and belongs to family Amaryllidacea. It is shallow-rooted, herbaceous and half hardy with light green, long grass like leaves grow up to 60-120cm in habitat. Tuberose is a one of the leading commercial cut as well as loose flower crop due to its eye-catching spikes with pleasant fragrance and long vase life. Loose flowers are used in floral ornaments

such as artistic garlands, veni, gajras, and buttonholes etc and are also used for medicinal or cosmetic purpose whereas cut flowers are used in vase decoration or in flower arrangements.

Flowers of tuberose are rich in fragrance. It contains eugenol, geraniol, nerol, methyl benzonate, benzyl alcohol, methyl anthranilate and benzyl benzoate. Moreover natural oil extracted from tuberose is one of the most expensive raw material for perfume industry (Kabir *et al.,* 2011) and cosmetic industry. It is also used in aromatherapy due to its ability to tranquil the nerves, peace, restore joy and harmony. Tuberose responded well to the application of synthetic fertilizers however period of vegetative growth and flowering in the field can be enhanced through the utilization of organic fertilizer (Islam, 2011).

Vermicompost can enhance crop production by amending soil physical, chemical and biological properties. It contains 1.9 % of nitrogen, 2 % of phosphorus, 0.8 % of potassium, 500mg/kg of Mn and 100mg/kg of Cu (Kumar and Chuadhay, 2018). Azospirilum bacteria can fix about 20- 25kg of N per hectare and can recover soil fertility (Alexander *et al.,2009*). Beside this it can also produce growth regulators, sederophores and antifungal or anti-bacterial compounds. Phosphate solubilising bacterias improve the P accessibility in soil by mineralizing organic phosphorous (Chen *et al.,*2006).

MATERIALS AND METHODS

The field trial was laid out in randomized block design with three replications during the year 2020-2021 to evaluate the effect of organic, inorganic and bio-fertilizer nutrient sources on growth and flowering parameters of tuberose *(Polianthes tuberosa Linn.)* cv. Prajwal, in the Experimental farm of C.C.R. (P.G.) College, Muzaffarnagar (western U.P.). The experiment consist of eight treatments viz., [T_1] Control; [T_2] R.D.F.; [T_3] 50% R.D.F.+ 50% Vermicompost; [T_4] 75% R.D.F. + 25% Vermicompost; [T_5] 75% R.D.F.+ 25%Vermicompost + Azospirillum; [T_6] 75% R.D.F. + 25%Vermicompost + P.S.B.; [T_7] 75% R.D.F. +25% Vermicompost + Azospirillum + P.S.B.; [T_8] 50% R.D.F. + 50% Vermicompost + Azospirillum + P.S.B.. well decomposed Vermicompost and bio-fertilizers were applied as per treatment allocation to the plots uniformly. Inorganic fertilizers were broadcasted in the form of urea, single super phosphate and muriate of potash. At initial stage, half dose of nitrogen and full dose of phosphorous and potash was applied and left over half dose of nitrogen was applied after 30 days of transplanting. The uniform size bulbs of tuberose with diameter 2.0- 2.5 cm were used as sowing material. Intercultural operations such as hoeing, weeding, fertilization, irrigation, earthing up and staking etc were followed for all the treatments.

RESULTS AND DISCUSSION

The results revealed that the effects of different nutrients combination on vegetative characters such as days taken to sprouting, plant height, number of leaves per plant and leaf area per plant and floral characters i.e. days taken to first spike emergence, no. of spikes per plant, length of spike, length of rachis, no. of florets per spike, diameter of the floret (cm), flower duration were found better in combination of organic, inorganic and bio-fertilizers applied to plants as contrast to only chemical fertilizers or control applied.

The effect of nutrients on days taken to sprouting of bulb was recorded earlier with the application of T_7(75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.) and T_6(75% R.D.F. + 25% Vermicompost + P.S.B), whereas the most delayed emergence was recorded with control followed by T_2 & T_3 (These findings are similar with the investigation of Padaganur *et al.,* 2005 and Kabir *et al.,* 2011 in tuberose flowers). Vermicompost is

highly porous, with good aeration, drainage and water-holding potential. It has the capability to enhance surface areas, providing more micro-sites for microbial decomposing organisms, and strong adsorption and retention of nutrients (Shishehbor *et al.,* 2013) which may aid in early sprouting of bulbs.

The highest plant height during the different stages of has been seen with the application of T_7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.) while the minimum plant height was recorded with T_1 (control). Improvement in growth parameters might be due to full supply of nutrients especially Nitrogen during early stages of plant development. Beside this, vermicompost might have improved the effect of availability of nutrients for a longer period of time (similar findings by Rao *et al.,* 2015). PGR present in vermicompost may also help in cell division and cell elongation which can elongate height of leaves. Moreover nitrogen and phosphorus are major constituents of D.N.A. hence they are a vital source for protein synthesis and their availability for a longer period of time ultimately results in healthy vigorous morphological growth. (Dahiya *et al.,*2001 and Yadav *et al.,* 2005).

The maximum number of leaves per plant was found with the application of T_7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.) while the minimum number of leaves per plant was recorded with T_1 (control). These findings in the present investigation are in conformity with those reported earlier by Rao *et al.*, 2014 and Basant *et al.*, 2020. The combination of inorganic fertilizer with organic and bio-fertilizers in optimum application is more effective than manure or inorganic fertilizer alone in influencing the number of leaves (Kuotsu *et al.,* 2018 in gladiolus). Vermicompost is a rich source of NKP (nitrogen 2-3%, potassium 1.85-2.25% and phosphorus 1.55-2.25%) and micronutrients. It also contains beneficial enzymes and plant growth regulators which can improve the efficiency of soil microbes. Vermicompost retains nutrients for a longer period of time and whereas R.D.F. fails to deliver the required amount of nutrients for longer periods, that's why application of vermicompost enhances vegetative growth (Sinha *et al.,* 2009).

The effect of nutrients on days taken to spike emergence was observed earlier with the application of 75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B. while the most delayed first spike emergence was recorded with control. These findings in the present investigation are similar with the findings of Chaudhary, S. V. S. (2009) and Chopde *et al.,* in 2007. This may be due to presence of micronutrients in vermicompost such as Zn, Fe, Cu etc as these micronutrients are effective in reducing the juvenile period of plants (Kumar *et al.,* 2012). The application of 75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B. also exhibits maximum number of spikes per plant whereas the minimum numbers of spikes were recorded with control (T_1) and R.D.F. (T_2). These observations are in conformity with those reported earlier with Shankar *et al.,* 2010.

Different treatments of inorganic amendments, organic manures and bio-fertilizers show significant effect on the length of flower spike in tuberose. The maximum length of spike per plant was recorded with the application of T_7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.) while the minimum length of spike was recorded with T_1 (control). These findings are similar with those reported earlier by Shankar *et al.,*2010 and Satapathy *et al.,*2016 in gladiolus. Increase in spike length because of application of inorganic fertilizer along with vermicompost and biofertilizer might have helps the plants to synthesize more photosynthates which can later supplied to spike for their development or this may also be due to increased availability of all essential macro and

micro-nutrients in easily available form. Moreover PGR present in vermicompost can cause both cell elongation and division that can stimulate elongation (Rao *et al.*, 2015 and Gayathri *et al.*, 2004).

Length of rachis for different treatments represents significant variation in tuberose. The utmost length of rachis was recorded with the application of T_7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.) while the minimum length of rachis was observed in T_1 (control). These observations and findings were similar with Padanagur VG *et al.,* 2005 and Satapathy *et al.,* 2016. Enhanced rachis length may be due to the presence of Gibberellin in vermicompost. Gibberillin leads to cell elongation and division that can enhance the rachis length (Rao *et al.,* 2014.). Moreover macro and micro nutrients present in vermicompost may activate several enzymes (catalase, peroxides, alcohol dehydrogenase, carbonic dehydrogenase, tryptophan synthetic, etc.) which regulate all physiological functions inside plants (Padanagur VG *et al.,* 2005 in tuberose). The floret number is one of the chief parameter of tuberose. Under this investigation variations were observed for the number of florets per spike for the different treatments. The maximum number of florets per spike was recorded with the application of T_7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.) whereas the minimum number of florets was observed in T_1 (control). These findings in the present investigation are in conformity with those reported earlier by Basant *et al.,*2020.

It was revealed from the investigation that the diameter of the floret (cm) depicts variation. The highest diameter of florets was recorded with the application of T7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.) while the smallest diameter of florets was recorded with T1 (control) (similar with the findings of Basant, *et al.,*2020). The application of adequate nutrients through inorganic fertilizers in combination with vermicompost might result in cell elongation which would have resulted in an increase in length and diameter of floret (Gharat *et al*., 2008 (aster flower) and Deshmukh *et al*.,2008.

Application of organic, inorganic and bio-fertilizers had a significant effect on the flower duration of tuberose. The maximum flower duration was recorded with the application of T7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.) whereas the minimum flower duration was recorded with T1 (control). These observations were similar with Waheeduzzama *et al.,* 2006 in anthurium and by Rao *et al.,* 2014. The longer durability of flowers may be due to optimum release of nutrients by nutrient sources in the plant tissues and their continuous supply to the flowering spikes which might have enhanced the quality of the spikes and more florets and longer durability of individual florets. (Kuotsu *et al.,*2018)

CONCLUSION

It can be concluded from the current investigation that the combined application of vermicompost along with R.D.F., Azospirillum and P.S.B. can significantly influence the vegetative and floral traits of tuberose. Hence, it is advantageous for tuberose yield production and can be recommended for commercial cultivation in western region of U.P.

Fig. No. 1 - Sprouting of bulbs

Fig. No. 2 - Vegetative growth after 60 days after transplanting

Fig. No 3 - opening of florets

Table - 1 : Effect of Vermicompost with Bio-fertilizers on growth and flowering attributes of tuberose (*Polianthes tuberosa Linn.*) cv. prajwal

Treatments	Days taken to sprouting of bulb	Plant height (cm).	Number of leaves per plant	Leaf area per plant (cm^2)	Days taken for first spike emergence	No. of spike per plant	length of spike (cm)	length of rachis (cm)	No. of florets per spike	Diameter of the floret (cm).	Flower duration (days)
T1 (Control)	14.27	57.33	24.33	925.11	81.89	1.27	86.27	28.53	40.93	3.44	14.39
T2 (R.D.F.)	13.87	60.80	25.07	1039.12	81.69	1.27	88.18	29.07	43.60	3.91	14.95
T3 (50% R.D.F.+ 50% Vermicompost)	13.87	60.93	26.13	1220.97	80.12	1.60	90.69	29.70	45.67	4.30	15.40
T4 (75% R.D.F.+ 25 Vermicompost)	13.47	61.40	26.60	1183.31	78.33	1.93	93.10	30.53	47.40	4.33	16.04
T5 (75% R.D.F.+ 25% Vermicompost + Azospirillum)	13.60	62.87	27.60	1353.07	77.32	2.03	94.69	31.53	47.73	4.40	16.59
T6 (75% R.D.F. + 25% Vermicompost + P.S.B.)	12.93	61.93	27.53	1328.20	76.77	2.27	97.05	31.71	48.20	4.72	17.23
T7 (75% R.D.F. + 25% Vermicompost + Azospirillum + P.S.B.	12.93	65.27	28.93	1507.43	74.75	3.30	98.37	33.37	51.20	4.81	19.21
T8 (50% R.D.F. + 50% Vermicompost + Azospirillum + P.S.B.	13.00	64.67	28.20	1421.33	75.47	2.97	98.07	32.85	50.13	4.55	18.38
S.E (m) ±	0.12	0.21	0.26	29.99	0.34	0.10	0.24	0.25	0.44	0.11	0.15
CD(P=05)	0.37	0.65	0.80	91.84	1.03	0.32	0.74	0.75	1.34	0.33	0.47
CD(P=01)	0.49	0.86	1.06	122.30	1.37	0.42	0.98	1.00	1.79	0.44	0.63
CV (%)	1.55	0.59	1.69	4.16	0.74	8.6	0.45	1.37	1.62	4.31	1.61

REFERENCES

1. Chaudhary, S. V. S. (2009). Influence of various biofertilizers on growth, flowering and bulb production in tuberose (*Polianthes tuberosa Linn.*) cv. Double. *Annals of Horticulture* 2 (1): 92-94.
2. Chen, Y. P., Rekha, P. D., Arunshen, A. B., Lai, W. A. and Young, C. C. (2006). Phosphate solubilizing bacteria from subtropical soil and their tricalcium phosphate solubilizing abilities. *Applied Soil Ecology, 34:33-41*
3. Chopde, M.P., Pillewan, Shalini and Bhongle, S.A. (2007). Integrated nutrient management in tuberose. *Advances in Plant Science., 20 (2) : 443-444.*
4. Deshmukh, P.G., Khiratkar, S.D., Badge, S.A. and Bhongle, S.A. (2008). Effect of bio Iinoculants with graded doses of NPK on growth and yield of gaillardia. Journal of *Soils & Crops, 18 (1) : 212-216.*
5. Dr. D. Alexander, Dr. S. Rajan, Dr. L. Rajamony, Dr. K. Ushakumari, Dr. Sajan Kurien (2009). The adhoc package of practices recommendations for organic farming.
6. Durgeshwar Kumar Basant, LS Verma, Ram Singh and Ishwar Ram Markam. (2020). Effect of nutrient management on growth, flowering and flower yield of tuberose *(Polianthes tuberose L.)* under Chhattisgarh plain condition. *International Journal of Chemical studies 2020; 8(2): 249-253*
7. Gayathri, H N Jayaprasad and Narayanaswamy, P. (2004). Response of biofertilizers and their combined application with different levels of inorganic fertilizers in statice. *Journal of Ornamental Horticulture 7(1): 70- 74.*
8. Gharat, S.A., Rohidas, S.B., Patil, M.B. and Nawghare, P.D. (2008). Impact of organic and Inorganic fertilizers on yield and quality parameters of aster flower var. California Giant. *Journal Of Maharashtra Agricultural Universities: 1, 103-104.*
9. Islam, F. (2011): Influence of organic amendments and EM on yield and preservatives on vase life of gladiolus. An MS thesis submitted to Dept. of Horticulture. BSMRAU, Salna, Gazipur. 60 p.
10. K. Dhanumjaya Rao, P. Lalitha Kameswari and T. Baby Rani (2015). Impact of integrated nnutrient management on growth, flowering, yield and economics of tuberose. *Agricultural Science Digest. 2015. (35):66-69*
11. Kabir AKMR, Iman MH, Mondal MMA, Chowdhury S. (2011). Response of tuberose to Integrated nutrient management. *Journal of Environmental Science and Natural Resources. 2011;4(2):55-59.*
12. Nini R. Kuotsu, Rokolhuii Keditsu and Laishram Hemanta (2018). Response of Organic and Inorganic Nutrient Sources on the Growth and Flowering of *Gladiolus primulinus* cv. Candyman. *International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706 Volume 7 Number 05 (2018)*
13. Marjan Shishehbor, Hamid Madani, Mohammad Reza Ardakani (2013). Effect of vermicompost and biofertilizers on yield and yield components of common millet (*Panicum miliaceum*). *Annals of Biological Research. 4(2);174-180*
14. Mukesh Kumar and Veena Chaudhary (2018). Effect of Integrated Sources of

Nutrients on Growth, Flowering, Yield and Soil Quality of Floricultural Crops: A Review. *International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706*

15. Padanagur V. G, Mokashi A. N, Patil V. S. (2005). Flowering flower quality and yield of Tuberose as influenced by vermi compost, farmyard manure and Fertilizers. *Karnataka Journal of Agricultural Sciences. 2005;18(3) : 729–734.*

16. Satapathy SPM, Toppo R, Dishri M, Mohanty CR. (2016). Impact of integrated nutrient management (INM) on flowering and corn production in gladiolus. *Biometrics & Biostatistics International Journal, 2016;4(7):296–298. DOI: 10.15406/bbij.2016.04.00119*

17. Shankar Lal, Lakhawat SS, Choudhary MK. (2010). Effect of organic manures and bio fertilizers on growth, flowering and bulb production in tuberose. *Indian Journal of Horticulture, 2010; 64(4):554-556.*

18. Sinha, Rajiv, Herat, Sunil, Valani, Dalsukhbhai, Chauhan, Krunalkuma (2009). Earthworms Vermicompost: A Powerful Crop Nutrient over the Conventional Compost & ProtectiveSoil Conditioner against the Destructive Chemical Fertilizers for Food Safety and Security. *American Eurasian Journal of Agricultural & Environmental Sciences.*

19. Waheeduzzama, mohd. Jawaharlal, M Arulmozhiyan, R and Indumathi, K (2006). Effect in INM practices on flower quality and vase life of *Anthurium andreanum* cv. Merngue. *Journal of Ornamental Horticulture 9(2):142*

Journal of Natural Resource and Development 17 (2) 8-14, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

EFFECT OF NEEM LEAVES AND GINGER POWDER AS INFLUENCED BY GROWTH PARAMETER IN BROILER CHICKS IN BATTERY TYPE CAGES

U.K. Shukla and Ravi Raj Bagri
Department of (N.R.M.) , Faculty of Agriculture
Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna - 485334, (M.P.), India
E-mail : umeshdr_2006@rediffmail.com

Received : 25.04.2022 Accepted : 28.05.2022

ABSTRACT

The present experiment entitled "Effect of Neem leaves and ginger powder as influenced by growth parameter in broiler chicks in "battery type cages" was carried out in small animal laboratory of Department of N.R.M. Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.). A total 45 day old broiler chicks of same hatch procured and randomly divided in to three groups and housed in battery type of cages consisting of three chickens in each to provide recommended floor space 0.75 ft in cages per broiler . Chick will be provided with self prepared ration as per following treatment combinations: T0- (Control) basal diet with no supplement, T1 - Neem 0.25% + basal dose , T2- Ginger 0.25% + basal dose, T3- Neem 0.25% +ginger 0.25% + basal dose, T4- Neem 0.5% + ginger 0.5%+ basal dose. The effect of the neem leaf and ginger extracts on body weight, feed consumption and water consumption and changes in blood profile were recorded before and during administration of treatment. The weight of each chicken was taken before feeding in the morning, in noon and afternoon. The average of these three weights was calculated and recorded. Mean live weight gain of each group of broilers on 7th and 42th days was recorded. The feed conversion ratio (FCR) was determined through the relationship between amount of feed consumed (FC) to the body weight gain (BWG) under each group of birds (FCR = FC g/BWG g). Consequently there is considerable research interest in the possible use of natural products, such as essential oils and extracts of edible and medicinal plants, herbs and spices, for the development of new additives in animal feeding. It may be concluded that there was a beneficial effect of Neem and ginger supplementation in diet of broilers on body weight gain in weight and feed conversion ration of broilers. For economic point of ration supplemented with T4- Neem 0.5% + ginger 0.5%+ basal dose feed was found the best compared to all the treatments.

Keywords : *Broiler chicks, growth performance, neem leaf powder, ginger powder.*

INTRODUCTION

The poultry production systems led to marked increase in the production of poultry meat and eggs throughout the world *(Armstrong, 1986)*. It

has triggered the discovery and widespread use of a number of "feed additives". The term feed additives is applied in a broad sense, to all products other than those commonly called feedstuffs, which could be added to the ration with the purpose of obtaining some special effects. The main objective of adding feed additives is to boost animal performance by increasing their growth rate, better-feed conversion efficiency, greater livability and lowered mortality in poultry birds. These feed additives are termed as "growth promoters" and often called as non-nutrient feed additives (*Singh and Panda,1992).* The poultry farming in India occupies the top most position as compared to its other counterpart livestock with the annual growth rate of 8 and 15 % in respect of egg and poultry meat production Poultry meat is the fastest growing component of global meat production , consumption , and trade with developing economy playing a pivotal role in its growth due to its enormous potential to bring rapid economic growth with low investment (*Naghetini CC., 2006).* Neem (*Azadirachta indica*), popularly known as Indian neem (margosa) or indian lilac of the family maliaceae, is one of such non-conventional and avaible ingredients source in the tropics with great potential in the 21st century. it is tropical tree plant which is widely distributed in Afrika, and available all year round (Onyimonyi AE *et al.,* 2009;).

The medical properties of neem have been known to indians since time immemorial. the earliest sanskrit medical writings refers to the benefits of neems fruit , seeds, oil, leaves, roots and bark. Each has been used in the indian ayurvedic and Unani systems of medicines, and is now being used in the manufacture of modern day medicinal, cosmetics, toiletries and pharmaceuticals. The neem tree has been known as wonder tree for centuries in the indian subcontinent . Neem has become important in the global context today for its variety of medicinal uses ,Neem extract which have Nimbinin, nimbandiol as active constituents, alcoholic extract of the leaves was found to possess a used in significant blood sugar lowering effect, which are very useful against diabetes. Neem It has Dermatitis Eczema, Acne, Bacterial, Fungal infections and other skin disorders. demonstrated its effectiveness as a powerful antibiotie. Neem also has shown antiviral, anti fungal and anti - bacterial properties. It helps support a strong immune system and is used in cases of inflammatory skin conditions. Traditionally Neem has been used for skin and blood purifying conditions. (Bandyopadhyay *et al.,* 1999). Neem also plays an important role in strengthening the immune system of the body. Increase in antibodies against new castle and infectious bursal disease viruses have been observed when neem is included in poultry feeds(*Dono ND., 2014).* Unfortunately, the high fiber content in Neem leaf meal poses serious intake and digestibility problems in poultry diets (Udedible and Opara, 1998).

Ginger rhizome (*Zingiber officinale Roscoe, Zingiberaceae*) has long been used in the world as a popular spice food as well as a medicinal herb because of its high content of antioxidants and anti-inflammatory properties (H. Kikuzaki and N. Nakatani,1993 and R. C. Lantz *et.al. 2007)*. Studies by Nonn et al. have shown that 6-gingerol inhibited the TNF-α, and IL-1β-induced increase in the p38-dependent NF κB activation and expression of pro-inflammatory genes of IL-6 and IL-8 in normal prostatic epithelial cells (L. Nonn, D. Duong, and D. M. Peehl,2007).

MATERIALS AND METHODS

The present experiment entitled "Effect of Neem leaves and ginger powder as influenced by growth parameter in broiler chicks in "battery type cages" was carried out in small animal laboratory of Department of N.R.M. Faculty of Agriculture,

Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.).

A total 45 day old broiler chicks of same hatch procured and randomly divided in to three groups and housed in battery type of cages consisting of three chickens in each to provide recommended floor space 0.75 ft in cages per broiler . Chick will be provided with self prepared ration as per following treatment combinations:

- T_0- (Control) basal diet with no supplement
- T_1 - Neem 0.25% + basal dose
- T_2- Ginger 0.25% + basal dose
- T_3- Neem 0.25% +ginger 0.25% + basal dose
- T_4- Neem 0.5% + ginger 0.5%+ basal dose

The birds were reared in battery type cages under standard management practices from day old to five weeks of age .Iron was supplemented as per dietary regime of treatments. Broiler starter ration containing CP: 22 percent and ME:2900K.Cal./kg. feed was fed up to three weeks and broiler finisher ration containing CP: 19 percent and ME:3000 k.cal/kg. feed up to five weeks. The ration was fed *ad libitum* to the birds. Initial weight of each chick was recorded on arrival and then weekly to obtain the growth rate. The feed consumption was also recorded weekly to determine the feed conversion ratio .The mortality rate was also recorded during the experimental period. Chick were housed in battery type cages providing 0.75 sq.ft/birds space. Cages, feeder, waterer and other equipment's were properly cleaned, disinfected and sterilized before use. The waterer were disinfected with 0.02% KMO_4 solution every day and water was supplied *ad lib* to the birds .One bulb of 25 watt was left in each cage for light and to maintain the temperature in laboratory. The effect of the neem leaf and ginger extracts on body weight, feed consumption and water consumption and changes in blood profile were recorded before and during administration of treatment. The weight of each chicken was taken before feeding in the morning, in noon and afternoon. The average of these three weights was calculated and recorded. Mean live weight gain of each group of broilers on 7th and 42th days was recorded. The feed conversion ratio (FCR) was determined through the relationship between amount of feed consumed (FC) to the body weight gain (BWG) under each group of birds (FCR = FC g/BWG g).

The data recorded during the course of investigation was subjected to statistical analysis by "Analysis of variance technique". The significant and non-significant treatment effects were judged with the help of 'F' (variance ratio) table. The significant differences between the means were tested against the critical difference at 5% probability level.

RESULTS AND DISCUSSION

1.0- Average weekly body weight of broilers:-

weekly body weight of broilers ,contained ,it may be noted that body weight of broilers ,irrespective of treatments at one ,two ,three ,four and five weeks of age was 131.33 , 308.53 , 573.46 , 864 and 1149.47g, respectively. And the differences in these were significant , indicating thereby a significant effect of age on the body weight of broilers in all treatments .The results were expected ,because under normal condition the increase of body weight with the intake of feed is what one would expect with the increase in age of birds . when treatments –wise body weight of broilers was recorded at g was found highest in T_1(642.67g) and followed by, T_3 (234.40), followed by T_1 (225.20), T_2 (219.87), T_0 (218.40) and T_4 (206.40)g. The differences in these values of treatments were also found significant ,indicating thereby a significant effect of treatments on body weight of broilers. Significantly highest mean body weight of chicks was observed T_1 compared to other treatments.

However T_3 was found at par with T_1 and T_0, T_3 T_4, being non-significant difference between the treatments Farther the body weight of broilers in T_0, $T_3$and T_4did not differ significantly being at par .

2.0. Weekly Feed intake in broilers :-

weekly feed intake of broilers ,contained in Table 15, it may be noted that feed intake of broilers ,irrespective of treatments at one, two, three, four

Table - 1.0 : Average weekly mean body weight of broiler chicks (g) in different treatments

Weeks	body weight of broilers in different treatments					
	T_0	T_1	T_2	T_3	T_4	Mean
1	136.00	136.00	126.67	136.00	122.00	131.33
2	307.33	320.00	288.67	326.67	300.00	308.53
3	556.00	571.33	551.33	639.33	549.33	573.46
4	854.00	881.33	838.00	928.67	818.00	864.00
5	1140.00	1171.33	1145.33	1216.00	1074.67	1149.47
Mean	598.67	616.00	590.00	649.33	572.80	

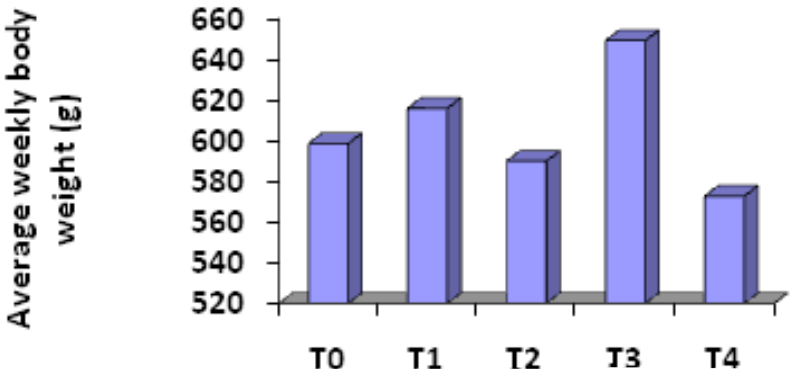


Fig. 1.0 : Average weekly body weight (g) of broilers in four different treatments

and five weeks of age was 143.47 , 305.77 , 436.03 , 519.25 and 728.67g, respectively. And the differences in these were significant , indicating thereby a significant effect of age on the feed intake of broilers in all treatments .the results were expected ,because under normal phenomenon. The increase in feed intake with increased age, is what are world expected with increase of age .When treatment were feed intake was recorded, the mean highest feed intake was significant in broilers of T_3 (234.40), followed by T_1 (225.20), T_2 (219.87), T_0 (218.40) and T_4 (206.40).. And the differences in this volume were found no significant. This indicate that supplementation of Neem and ginger did not influence the feed intake of broilers.

Table - 2.0 : Average weekly means feed intake of broiler chicks (g) of different treatments.

Weeks	Feed in intake of broilers in different treatments					
	T_0	T_1	T_2	T_3	T_4	Mean
1	132.00	150.00	138.03	157.30	140.00	143.47
2	276.07	310.03	295.33	324.07	323.33	305.77
3	447.33	444.60	421.30	444.63	422.30	436.03
4	550.00	523.33	501.00	533.30	488.60	519.25
5	700.99	700.99	719.11	765.23	757.03	728.67
Mean	421.28	425.79	414.95	444.91	426.25	

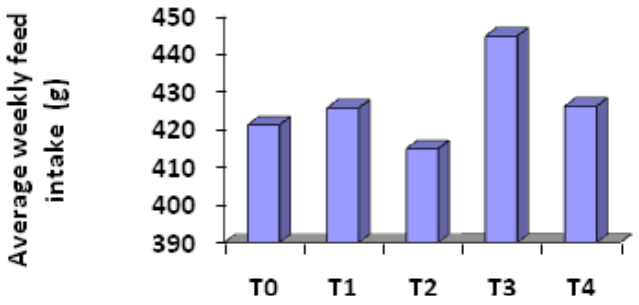


Fig. 2.0 : Average weekly feed intake of broilers

3.0 Average weekly gain in weight of broilers of different treatments (g):

weekly gain in weight of chicks per broiler ,contained in Table 17,it may be noted that gain in weight per broiler ,irrespective of treatments at first, second, third, fourth and fifth week of age was 86.13 , 177.2 , 264.93 , 290.53 and 285.47g , respectively. and the differences in these were non-significant , indicating thereby significant effect of age on the gain in weight of broilers in all treatments the results were expected ,because under normal phenomenon. With increase of age ,feed intake in also increase and this is what are world expected .when treatment were feed intake was recorded ,the weight ,feed intake was recorded ,the highest feed intake was observed T3 (234.40), followed by T1 (225.20), T2 (219.87), T0 (218.40) and T4 (206.40).

Table - 3.0 : Average weekly means gain in weight (g) per broiler of different treatments:

Weeks	gain in weight (g)					
	T0	T1	T2	T3	T4	Mean
1	88.00	90.67	80.67	92.00	79.33	86.13
2	171.33	184.00	162.00	190.67	178.00	177.20
3	248.67	251.33	262.67	312.67	249.33	264.93
4	298.00	310.00	286.67	289.33	268.67	290.53
5	286.00	290.00	307.33	287.33	256.67	285.47
Mean	218.40	225.20	219.87	234.40	206.40	

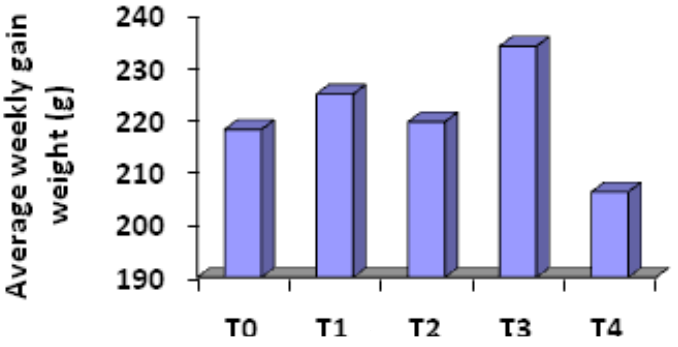


Fig. 3.0 : Average weekly gain in weight of broilers

4.0 Average weekly FCR of broilers of different treatments (g.feed per kg of gain in (weight):

weekly FCR per broiler ,contained in Table 19,it may be noted that FCR per broiler ,irrespective of treatments at first, second, third, fourth and fifth weeks of age was 1.68 , 1.74 , 1.66 , 1.81 and 2.58g, respectively, and the differences in these were non-significant , indicating thereby non-significant effect of age on the FCR of broilers in all treatments .When treatment wise FCR was recorded highest FCR observed in T2(1847.20) followed by T4 (2.03), followed by T2 (1.88), T3 (1.88), T1 (1.85) and T0 (1.84).. However these velum of FCR affect significantly being at par.

Table - 4.0 : Average weekly mean (FCR) or feed efficiency per broiler in different treatments:

Weeks	Feed conversion ratio (g)					
	T0	T1	T2	T3	T4	Mean
1	1.52	1.66	1.75	1.71	1.77	1.68
2	1.62	1.69	1.86	1.70	1.82	1.74
3	1.79	1.77	1.62	1.43	1.69	1.66
4	1.85	1.69	1.83	1.88	1.82	1.81
5	2.43	2.43	2.36	2.66	3.03	2.58
Mean	1.84	1.85	1.88	1.88	2.03	

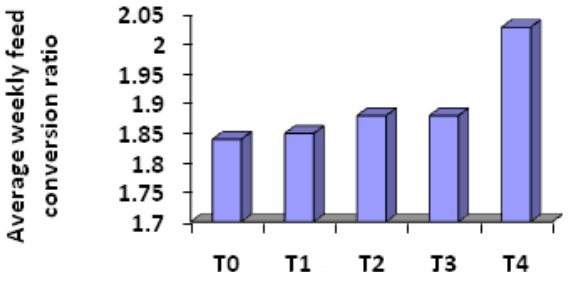


Fig. 4.0.: Average weekly feed conversion ratio of broilers

CONCLUSION

Consequently there is considerable research interest in the possible use of natural products, such as essential oils and extracts of edible and medicinal plants, herbs and spices, for the development of new additives in animal feeding. It may be concluded that there was a beneficial effect of Neem and ginger supplementation in diet of broilers on body weight gain in weight and feed conversion ration of broilers. For economic point of ration supplemented with T4- Neem 0.5% + ginger 0.5%+ basal dose feed was found the best compared to all the treatments.

REFERENCES

1. Armstrong DG., (1986). Gut active growth promoters. In: Control and manipulation of animal growth. Eds. By Buttery PJ, Lindsay DB and Haynes NB pp. 21-37.
2. Bandyopadhyay U, Das D, Banerjee RK., (1999). Reactive oxygen species: oxidative damage and pathogenesis. Curr Sci; 77:658-666.
3. Dono ND., (2014). Turmeric (Curcuma longa Linn.) supplementation as an alternative to antibiotics in poultry diets. WARTAZOA. Indonesian Bulletin of Animal and Veterinary Sciences 23(1):419.DOI.10.14334/wartazoa.v23i1.958.
4. H. Kikuzaki and N. Nakatani, (1993) "Antioxidant effects of some ginger constituents," Journal of Food Science, vol. 58, no. 6, pp. 1407–1410, 1993.
5. L. Nonn, D. Duong, and D. M. Peehl, (2007). "Chemopreventive anti-inflammatory activities of curcumin and other phytochemicals mediated by MAP kinase phosphatase-5 in prostate cells," Carcinogenesis, vol. 28, no. 6, pp. 1188–1196, 2007.
6. Naghetini CC., (2006). Caracterização físico-química e atividade antifúngica dos óleos essenciais da cúrcuma. Dissertação (Mestrado em Ciência de Alimentos)-Faculdade de Farmácia, Universidade Federal de Minas Gerais, Belo Horizonte. P-1354.
7. Onyimonyi AE, Adeyemi O and Okeke GC (2009). Performance and economic characteristics of broilers fed varying dietary levels of neem leaf meal (Azadirachta indica). International Journal of Poultry Science, 8:256-259.
8. R. C. Lantz, G. J. Chen, M. Sarihan, A. M. Sólyom, S. D. Jolad, and B. N. Timmermann,(2007). "The effect of extracts from ginger rhizome on inflammatory mediator production," Phytomedicine, vol. 14, no. 2-3, pp. 123–128, 2007.
9. Singh KS and Panda B (1992). Feed additives. In: Poultry nutrition. 2nd edn. Kalyani. Delhi, pp. 134-143.
10. Udedibie ABI, Opara CC (1998): Responses of growing broilers and laying hens to the dietary inclusion of leaf meal from Alchorni cordifolia. Animal Feed Science and Technology 71, 157–164.

Journal of Natural Resource and Development 17 (2) 15-20, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

STUDIES ON EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON PAPAYA (CARICA PAPAYA L.) VARIETY : PUSA DWARF

Anant Kumar Umar Vaishy, Manoj Kumar Singh, Surya Narayan, Rajendra Prasad, Vishwanath, Dharmendra Kumar Singh and Vivek Kumar Srivastava

Department of Horticulture and Department of Entomology

K.A.P.G. College, Prayagraj - 211002, (U.P.), India.

Corresponding Author Email: manojkumarsingh197@gmail.com

Received : 19.07.2022 Accepted : 20.08.2022

ABSTRACT

The field experiment was laid out in Randomized Block Design (RBD) with three replicated 7 treatments viz. T_1: Recommended dose of fertilizer (RDF), T_2: 80%RDF+20%BF, T_3:60%RDF+40%BF, T_4:40%RDF+60%BF, T_5:20%RDF+80%BF, T_6:0%RDF+100%BF, T_7:50%RDF+50%BF. The soil of the site is sandy loam with 100.41 kg available N, 213.81 kg available P, and 100.04 kg available K per hectare. The crop was fertilized with Recommended dose Fertilizer of 150 g N, 100 g P and 80 g K and also Bio-fertilizers (Azotobacter + Azospirillum + Phosphorous solubilising bacteria) are applied as per treatments. Observations were recorded on plant growth parameters. The results revealed that papaya plants treated with treatment T_3 (60%RDF+20%BF) exhibited maximum results in the following parameters like plant height (65.87 cm), number of functional leaves (25.3), leaf area (698 sq cm).

Keywords : *RDF, papaya, growth, bio-fertilizer*

INTRODUCTION

Papaya *(Carica papaya* L) belongs to the family Caricaceae, is an evergreen, picturesque, straight growing and softwood plant It is sixth most important fruit in India in both area and production. The total 70,100 hectare,area is covered under papaya with a total production of 1.76 mt in India (Kalloo, 2003). Papaya is grown in tropical and subtropical regions of country covering Andhra Pradesh, Tamil Nadu, Assam, Bihar, Maharastra, Uttar Pradesh, Gujarat, Punjab, Haryana, Madhya Pradesh, Karnataka, Kerala and Best Bengal states.

The nutrition of papaya crop differs from other fruit crops because of its quick growth, continuous fruiting habit and heavy fruit yiel.d- On the basis of earlier work. Done the application of chemical fertilizers @ 200-250 g N. 200- 250 g P205 and 250-500 g K20' plant year'1 (Ram, 1982) 250 g N, 1 lOg P205 and 415 g K20 Plant(Purohit, 1977) have been recommended to meet out the nutrients requirement

of papaya. In addition to higher cost and energy involves in the production of chemical fertilizer (Das and Biswas, 2002) the use of chemical fertilizers concern on decline in productivity due to deteriorating effect on soil physical and chemical environment (Nambiar and Abrol, 1989;Lai and Mathur, 1989) and depleting conventional energy sources. During the last decade the productivity of the crop in the country has been more and less static due to excessive use of chemical inputs without adequate organic manure addition. These problems draw the attention of scientist to search some other alternative not dependent solely on chemical fertilizers. AN INM (Integrated Nutrients Management) is one of most effective alternatives which involves use of chemical fertilizers organic manures and bio-fertilizers for the maintenance of long term soil fertility and productivity along with sustainable production of crops

Integrated plant Nutrient Management aims to use nutrient in a more rational way (yield targeted, site and soil specific) understanding the interaction of different nutrients; use combinations of minerals and organic fertilizers; provide nutrients on a cropping system/rotation basis and use on-farm waste through recycling. Nutrient cycling is an important component of conservation Agriculture, in which minimum soil disturbance, intercropping, crop rotations and a permanent soil cover minimize the need for chemical fertilizers.

Biofertilizer play a very significant role in improving soil fertility by fixing atmospheric nitrogen both in association with plant roots and without it. It solubilizes insoluble soil phosphate and produces plant growth substances in the soil. They are playing friendly environment with a significant role in crop production. The soil lose its biological dynamism owing to repeated and indiscriminate use of inorganic source of fertilizer. The global mandate (Dorrel and Besson, 1996) today is to use organic source of plant nutrients to restore the soil health. The fertilizers are not only short in supply but costly too and produced at the cost of irreparable loss of non-renewable energy are able to fix atmospheric nitrogen in the range of 20- 200 kg/ha/year, solubilize P in the range of 30- 50 kg P_2O_5/ha/year; mobilize p "Zn, Fe, Mo to varying extent. They also help host plants to resist diseases and withstand stress conditions by different mechanism which vary depending upon the type of biofertilizer agent involved. Nitrogen fixing bacteria and phosphate solubilizer are the main biofertilizers for horticultural crops. These micro-organisms are either free living in soil or symbiotic with plants and contribute directly or indirectly towards nitrogen and phosphorus nutrition of the plants.

MATERIALS AND METHODS

The present experiment "Effect of Integrated nutrient management on Papaya (*Carica papaya* L.) variety: Pusa dwarf" was conducted at Horticultural Research Station (HRS), Department of Horticulture KAPG, College Prayagraj during the year 2021-2022. This region falls under IV Agro climatic zone of Uttar Pradesh state. The field experiment was laid out in Randomized Block Design (RBD) with three replicated 7 treatments *viz*. T_1:Recommended dose of fertilizer(RDF), T_2:80%RDF+20%BF, T_3:60%RDF+40%BF, T_4:40%RDF+60%BF, T_5:20%RDF+80%BF, T_6:0%RDF+100%BF, T_7:50%RDF+50%BF.

The experimental site located at college farm, College of K.A.P.G College, Prayagraj comes under sub-tropical zone and is situated at altitude of 25.450' N and longitude of 81.840' E in the southern part of the Uttar Pradesh at the elevation of 98 meters (322ft) and stand at the confluence of two, the gangas and Yamuna. The altitude of the place is 90m (295ft) above mean sea level. The mean annual precipitation on the basis of last ten years is 767mm (30.21 inches) which is received almost from South-

West Monsoon during July to September. The average minimum and maximum temperatures recorded during crop growth period were 12.68°C and 32.67°C respectively. The average humidity ranges from 33.38 % to 81.93%. Prayagraj (dist) thus has hot dry summer and moderate cold winter.

RESULTS AND DISCUSSION

Growth parameters

The observation of Plant height, Number of leaves and leaf area were taken 2 month (November) after planting of seedling while the last observation was recorded in the month of May.

1. Plant Height

The plant height of the crop recorded from 2nd month onward has been presented in Table 1 Fig 1. The effect of different combination of N:P:K and bio-fertilizer treatments revealed significance variation among treatments. It is obvious from the table-1 and figure-1 that the various combination of N:P:K and bio-fertilizer treatments influence the height of plant.

After two month (Nov.) of planting maximum plant height was recorded with T_3 application 30 cm, followed by T_4 and T_2 application that is 27.5 and 26.7 cm respectively. At November month lowest plant height (20.36 cm) was recorded with T_6 application.

Plant gain its maximum height in the month of April and its remain same in the last month (May) of experiment. In the month of April maximum plant height (65.87 cm) was recorded with T_3 application and the lowest (52.43 cm) with T_6 application.

The height of plant at all month of growth (Nov., Dec., Jan., Feb., March, April, May) was recorded maximum(30cm, 52.1 cm, 55.43cm, 56.94cm, 61.1cm, 65.87cm, and 65.87cm) respectively under treatment T_3. Thus T_3 showed superiority over other treatments at all successive stages.

Table - 1 : Effect of various treatments on plant height (cm) in different months per plant

Treatments / Months		Nov.	Dec.	Jan.	Feb.	March	April	May
T1	RDF	23.36	31.5	47.79	49.17	51.60	55.93	55.93
T2	80%RDF+20%BF	26.7	42.2	54	54.7	57.87	62.20	62.20
T3	60%RDF+40%BF	30	52.1	55.43	56.94	61.1	65.87	65.87
T4	40%RDF+60%BF	27.5	44.6	53.22	56.4	60.77	63.56	63.56
T5	20%RDF+80%BF	25.1	38.6	48.78	49.2	53.10	60.23	60.23
T6	0%RDF+100%BF	20.36	29.13	47.23	48.8	50.1	52.43	52.43
T7	50%RDF+50%BF	26.3	41.07	49.72	51.1	55.27	62.07	62.07
CD(P=0.05)		3.58	1.91	2.73	3.43	6.40	3.55	5.01

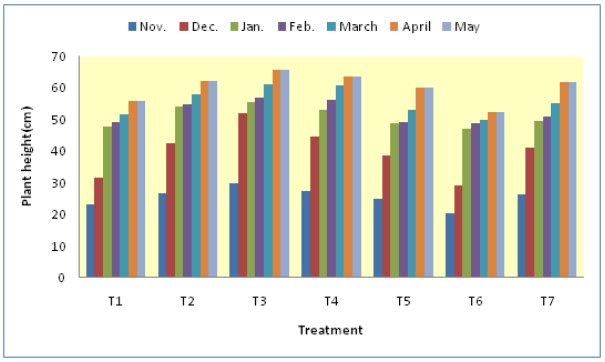


Fig. 1 : Effect of various treatments on plant height (cm) in different months per plant

2. Number of leaves

At two month old the papaya crop plant had the average number of leaves ranging from 9.5 to 14.4, lowest with 0%RDF+100%BF and highest with 60 % RDF +40% BF (Table 2). Maximum number of leaves per plant was recorded during 3rd month (Dec.) of growth which varied between 12.74 and 25.3, thereafter number of leaves, started decreasing, by 8th month it was brought down to a range of 7.83 to 14.1 (Fig. 2).

From table 2 it is clear that highest number of leaves at different month of growth was recorded with the treatment T_3 (60%RDF+40%BFs). Thus T_3 showed superiority over other treatments at all successive stages.

Table - 2 : Effect of various treatments on number of functional leaves at different months of growth per plant

Treatment Months		November	December	January	February	March	April	May
T1	RDF	9.7	14	13.43	13.2	10.67	9.53	8.6
T2	80%RDF+20%BF	11.3	17.5	16.03	16	12.6	11.5	11.5
T3	60%RDF+40%BF	14.4	25.3	15.2	19.1	15.1	13.33	14.1
T4	40%RDF+60%BF	12.9	18.92	16.8	18	10.7	10.57	12.5
T5	20%RDF+80%BF	9.7	15.87	14.61	15.1	11.32	11.03	11
T6	0%RDF+100%BF	9.5	12.74	15.22	12.8	9.93	6.32	7.83
T7	50%RDF+50%BF	10.4	17.53	15.82	15.6	12.07	10.47	12.1
CD(P=0.05)		0.97	2.30	3.17	2.22	2.11	3.32	1.37

3. Leaf area

The leaf area of papaya crop at two stages of crop growth has been presented in Table 3. At 3 month stage of crop growth highest leaf area (560.97 cm^2) was recorded with T_3 application followed by T_4 application (527.40 cm^2) and the lowest leaf area was recorded with T_6 application (326.33 cm^2)

Same trends observed at 4 month stage of planting highest leaf area was recorded with T_3 application (698.63 cm^2) and the lowest leaf area with T_6 application (370.30 cm^2)

From table 3 it is clear that highest leaf area at 3rd and 4th month of growth was recorded with the treatment T_3 (60%RDF+40%BFs). Thus T_3 showed superiority over other treatments at all successive stages.

Table - 3 : Effect of various treatments on leaf area (cm^2) of papaya crop

Treatments		At 3 Month Stage	At 4 Month Stage
T1	RDF	421.00	441.53
T2	80 %RDF+20%BF	512.63	522.67
T3	60 %RDF+40% BF	560.97	698.63
T4	40 %RDF+60%BF	527.40	649.30
T5	20% RDF+80% BF	468.40	466.50
T6	0%RDF+100%BF	326.33	370.30
T7	50%RDF+50% BF	511.60	519.63
SEm (±)		65.79	60.9
CD(P= 0.05%)		NS	187.8

CONCLUSION

The result of field investigation (2021-2022) revealed that growth parameter of papaya plant response well under appropriate combination of inorganic fertilizer and bio-fertilizer. Combination of 60% RDF (recommended dose of fertilizer) + 40% BFs (T_3 application) showed best result over all the treatment.

A combination of 0%RDF+100%BFs (T_6 treatment), means no inorganic fertilizer are applied from outside only full dose of bio-fertilizer are applied to the plant gave the lowest growth parameter revealed that inorganic fertilizer is also necessary for plant growth.

REFERENCES

1. Agrawal, N.; Panigrahi, H. K.; Tiwari, S. P.; Agrawal. R.; Sharma, D. and Dikshit, S. N. 2010. Effect offertigation through water-soluble fertilizers on growth, yield and quality of papaya (*Carica papaya*L). National Seminar on Precision Farming in Horticulture, pp:507-510.
2. Bisht, C.P., Solanki, R.B. and Singh. A. (2010). Effect of NPK and FYM on quality and leaf nutrient status for obtaining yield of papaya. *Annals of Horticulture.* **3**(8): 109-111.
3. Constantino, M., (2011). Effect of time of inoculation of Azotobacter and mycorrhizal fungi on growth and content nutrient of papaya seedlings in nursery phase. *Agronomia costarricense.***35**(1): 15-31.
4. Dwivedi, D. H., Singh, S., Singh, N and Kumar, P. (2015). Effect of Plant Bio-regulator and Chemical Treatment on Germination of Papaya (*Carica papaya* L.) cv. Pusa Nanha. Progressive Horticulture. 47 (2): 250-552.
5. Eda, R., D. V. Swami, B. P. Kumar, T. K. Patro andD. R. S. Suneetha. 2018. Effect of organic manures on fruit quality of papaya cv.Arka prabhat. *Int. J. Curr. Microbiol. App. Sci.* 7(12): 3605-3610.
6. Jadhav PB, Padhiar BV, Senapati AK, Gaware ND, Pokharkar KK.Effect of fertigation, splitting and mulching on first flowering height (cm), first flower initiation and days to fruit maturity after transplanting of papaya cv. Red Lady (786). International Journal of Current Research. 2016;8(6):32898-900.
7. Kanwar, A., Sahu, G. D., and Panigrahi, H. K. (2020). Impact of integrated nutrient management on yield and quality parameters of papaya (*Carica papaya* L.) Cv. Red Lady under net house. *Journal of Pharmacognosy and Phytochemistry*, *9*(3), 1443-1445.
8. Kirad, K. S., S. Barche and D. B. Singh. 2010. Integrated nutrient management in papaya (*Carica papaya* L.) cv. Surya. *In II*

International Symposium on Papaya. 851: 377-380.

9. Mamta, D. D., S. B. Gupta and S. Deole. 2017. Effect of integrated nutrient management on growth and nutrient uptake in papaya (*Carica papaya* L.) At nursery level. *J. Pharmacog. Phytochem.* 6(5): 522-527.

10. Marathe, R.A., Bharambe, P.R., Sharma, R. and Sharma U.C. (2012). Leaf Nutrient composition, its correlation with yield and quality of sweet orange Of central India. *Indian Journal of Horticulture*..**69**(3): 317-321.

11. Rajbhar, Y., Prasad, Singh, G. and Lal, M. (2010). Effect of N, P, K and spacing on growth and yield of papaya (*Carica papaya* L.) cv. pant papaya 1.Acta Horticulturae. **851.**

12. Ravishankar, H., Karunakaran, G., and Srinivasamurthy. (2010). Performance of coorg Honey Dew papaya under Organic Farming Regimes in the Hill Zone of Karnataka. *Acta Horticulture* **851**: 350-355.

13. Ray, P. K., A. K. Singh and A. Kumar. 2008. Performance of Pusa Delicious papaya under organic farming. *Indian J. Hort.* 65(1): 100-101.

14. Reddy, Y.T.N., Kurian, R.M., Ganeshmurthy, A.N., and Pannerselvam, P. (2010). Effect of organic nutrition practices on papaya (cv. Surya) fruit yield, quality and soil health. *Journal of Horticultural Sciences* . 11(2): 124- 127.

15. Reddy, Y.T.N., Prasad,S.r., Kurian, R.M., Ganeshmurthy, A.N., and Pannerselvam, p. (2012).Effect of organic nutrition practices on papaya (cv. Surya) .*Journal of Horticultural Sciences* . **7(**1): 88-90.

16. Shivakumar, B.S., Dharmatti P.R., and Channal, H.T.(2012). Effect of organic cultivation of papaya on Yield, economics and soil nutrient status. *Karnataka J. Agric. Sci.* **25** (4) : 488-492.

17. Singh, J. K., and Varu, D. K. (2013). Effect of integrated nutrient management in papaya (*Carica papaya* L.) cv. Madhubindu. *Asian Journal of Horticulture*, *8*(2), 667-670.

18. Singh K.K., Barche, S. and Singh, D.B. 2010. Integrated Nutrient Management in Papaya (*Carica papaya* L.) cv.Surya. *Acta Hort.*, **851**:377-380

19. Verma, K. S. and V. S. Kaushal. 2014. Nutritive assessment of different plant parts of *Carica papaya* Linn of Jabalpur region. *J. Nat. Prod. Plant Resour*. 4(1): 52-56.

Journal of Natural Resource and Development 17 (2) 21-26, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

IDENTIFICATION OF PERCEPTION AND CONSTRAINTS FOR LOCAL AND HYBRID VARIETY OF PADDY CULTIVATION IN AZAMGARH DISTRICT OF UTTAR PRADESH

Punit Kumar Agarwal[1], Saurabh Verma[2], Prem Chandra[3] and Dhyanesh Shukla[4]
Department of Agricultural Economics and Statistics
KAPG College Prayagraj - 211 002, (U.P.), India
Email : punitagriculture@gmail.com

Received : 31.05.2022

ABSTRACT

Paddy is important staple food crop for more than 60 per cent of world population. India has secured second rank in paddy production after China. In India Uttar Pradesh has Second position in paddy production. The present study with the objective to identify the perception and constraints for local and hybrid variety of paddy is carried out in Atraulia block of Azamgarh District. A list of all villages under Atraulia bock were prepared and arranged is in ascending order to the area covered under the paddy crop, 5 villages were selected randomly from this list. Total 100 respondents (50 for local variety and 50 for hybrid variety) were selected from 5 villages under study purpose. Garrett ranking technique was applied to identify the perception and constraints. The major perception and constraints of local variety were identified in study area as low land, low input requirement, poor condition, test and cooking quality, suitability of climatic condition where the major constraints were high incidence of disease and pests, low production , more time consuming, poor grain yield, depends on monsoon. The perception for adoption of hybrid variety were high yield, disease and pest resistance, high nutrients value, high market value where the major constraints for hybrid variety were high fertilizer consumption, requirement of managerial skilled labour, high input cost and output price fluctuation.

Accepted : 22.06.2022

Keywords : *local and hybrid variety of paddy, perception and constraints, price fluctuations, paddy cultivation, low input requirement.*

INTRODUCTION

Paddy is the most important and extensively grown food crop in the World. It is the staple food more than 60 percent of the world population. Rice is mainly produced and consumed in Asian region. India has largest area under paddy in the world and ranks second in the production after china. In, India paddy is the most important and extensively grown food crop, occupying nearly 450.67 lakh hectares area and the production has recorded 122.27 million tonnes (Annual report GOI 2020-2021). India has the largest area in the world accounting nearly 29 percent of the world area under rice. India occupies second position in the world's rice production

producing nearly 23.71% of production (Agricultural statistics at a glance, 2021). Hybrid rice normally has a yield advantage of 20-30 % over non hybrid rice cultivars. More than 80 percent of total hybrid rice area in India is occupied by Indian State like West Bengal, Uttar Pradesh, Punjab, Haryna, Andhra Pradesh, Odisha, Telangana, Tamil Nadu, Bihar, Chhattisgarh, Assam . As rice is a key source of livelihood in eastern India, a considerable increase yield through hybrid variety. In Azamgarh district the area, production and productivity of paddy cultivation is recorded 207312 hectare, 525724 metric tonnes and 24.57 quintal per hectare, respectively during 2018-19 (According to Sankhikiya Patrika 2020).The total value of the paddy cultivation in Azamgarh district is Rs. 16097668 thousand. The present paper has focused on perception and constraints faced by the respondents in study to grow the local and hybrid variety of the paddy. Some farmer basically based on low land growing local variety of paddy and has their own assumption and some are growing hybrid variety. So, to know the perception of adoption of local and hybrid variety and major challenges of the local and hybrid variety the study has done with the following objective.

MATERIALS AND METHODS

The study was based on the input and output data obtained from the respondents in Atrauliya block of Azamgarh district. For selection of respondent's multistage sampling design was employed. In this procedure, at first stage Azamgarh district selected purposively. From Azamgarh district Atrauliya (paddy growing) blocks following both local and hybrid variety of paddy cultivation were purposively selected. The block was selected purposively because of the earlier experience of work in the same block. Then on the third stage, five major paddy growing villages (Jamin Nandana, Majhipur, Paliya Karaudi, Chak Chaubey, Belsari) were selected from Atraulia block. In the final stage, 20 farmers were randomly selected from each village which comprising ten farmers for local and ten farmers for hybrid variety of paddy cultivation. Thus, the total sample size was 100.

Nature of Data:

For the present study, necessary primary data were obtained from the respondents through personal interview with the help of pretested and well-structured survey schedule and observation methods. The data collected, pertained to the kharif season of the agricultural year 2021-2022.

Analytical approach:

For analyzing perception and constraints of local and hybrid variety of paddy cultivation, Garrett's ranking technique was used.

Garrett's ranking technique

$$Percent\ Position = \frac{100(Rij - 0.50)}{Nij}$$

Where,

Rij is the rank given for i^{th} item by the J^{th} individual.

Nij is the number of items ranked by the J^{th} individual.

The percent position of each rank was converted in to scores using Garrett table. For each constraint, scores of individual respondents were added together and were divided by total number of respondents for whom scores were added. Thus, the mean score for each constraint was ranked by arranging them in descending order.

RESULTS AND DISCUSSION

First of all a list of preferences and challenges (for local and hybrid variety of paddy) was prepared with the help of discussion and observation basis then the five major preferences and challenges have selected from the list and ranked them according to Garrett ranking technique the result are given below

Preference for adoption of local variety of paddy cultivation by the farmers in study area

For the measurement of preferences for local variety of paddy cultivation data was collected from the respondent who were growing local variety of paddy. Some major reasons were identified from the list here and analyzed with Garrett ranking method.

It was observed from the table 1 that the low land was the main preference for growing local variety with means score 53.5 and it has first rank. At the time of data collection and observation many farmers have responded that low land is best suitable for local variety of paddy. Low input requirement is also a second major preference for growing local variety of paddy with the mean score of 52.2. The local of environment of the district and block is best suited for local variety so the suitable climatic condition was analyzed as a third preference for adoption of local variety of with mean score 50.1. Some farmers have opinion that the taste and cooking quality of local variety is better than hybrid variety so these variable have also included in the study and it has secured fourth preferences in adoption of local variety of paddy. Poor condition of the farmers is also a one of the reason for growing local variety of paddy with mean score 46.2.

Table - 1 : Preference for adoption of local variety of paddy cultivation

Reason/problem	Percent Position	Garrett Value	Mean Score	Rank
Low Land	10	75	53.5	1
Low Input requirement	30	60	52.2	2
Taste and Cooking quality	50	50	48.0	4
Poor Condition of the farmers	70	40	46.2	5
Suitable for climatic condition	90	25	50.1	3

Preferences for hybrid variety of paddy cultivation by the farmers

For measurement of preferences of hybrid variety of paddy cultivation data was collected from the respondent. Major reasons were identified here and analyzed with Garrett ranking method.

It was observed from the table 2 that the high yield was the main reason for growing hybrid varieties of paddy cultivation with mean score 60.7 it has the first rank. The hybrid variety of paddy is taking less time in production as compared to local variety generally the time duration of hybrid variety is 125-140 days while in case of local variety it takes 150-180 days. So it has on second position with the mean score of 58.3. Third main reason of growing

Table - 2 : Preferences for hybrid variety of paddy cultivation

Reason/problem	Percent Position	Garret Value	Mean Score	Rank
High Yield	10	75	60.7	1
Disease & Pest Resistance	30	60	47.3	3
Time Saving	50	50	58.3	2
High Nutrients value	70	40	45.2	4
High Market Value	90	25	34.9	5

hybrid variety of paddy is disease and pest resistance with 47.3 mean score. Hybrid variety of paddy has high nutrient value as compared to local variety so high nutrients value has the fourth major preference for the adoption of hybrid variety of paddy with 45.2 mean score. High market value is the fifth reason for growing hybrid variety of paddy with 34.9 mean score.

Constraints faced by the respondents in cultivation of local & hybrid variety of paddy

For the measurement of constraints confronted by respondents in cultivation of local and hybrid variety of paddy the data was collected and prepared a list and assigned rank through analysis of Garrett ranking method. Paddy crop is grown during the kharif season under rainfed condition the constraints faced by farmers in paddy cultivation under local and hybrid variety was different. Disease affected, more time consumption, low production, poor soil fertility, depends on monsoon etc. were identified in local variety of paddy cultivation where as managerial skill labour high fertilizer consumption, high cost of seed, high output price fluctuations etc. were identified under hybrid variety of paddy cultivation**.**

Table - 3 : Constraints of local variety of paddy cultivation

Problems	Percent Position	Garrett Value	Mean Score	Rank
High Incidence of Disease and Pest	10	75	64.8	1
More time consuming	30	60	57.5	2
Low Production	50	50	50.8	3
Poor Grain Yield	70	40	41.9	4
Depends on monsoon	90	25	35.0	5

The farmers were asked to list priority wise five major constraints they were facing in local variety of paddy cultivation. All these were shorted screened and given them a rank according to the Garrett method. High incidence of disease and pest was the biggest issue in local variety of paddy cultivation with the mean score 64.8. More time consuming were also major issues in study area followed by low production, poor grain yield and depends on monsoon for input and output with the mean score 57.5, 50.8, 41.9 and 35.0 respectively.

Constraints in practicing hybrid variety of paddy cultivation are presented in table 4.0

The farmers were asked to list priority wise five major constraints they were facing in hybrid variety of paddy cultivation. All these were shorted screened and give a rank according to the Garrett method.

A perusal of table 4 revealed that the high fertilizer consumption was the biggest constraint in hybrid variety of paddy cultivation with the mean score 56.8, followed by the requirement of managerial skill labour with the mean score of 54.9. The next major constraint in hybrid variety of paddy cultivation was high cost of seed with the mean score of 50.7. In hybrid variety of paddy cultivation inadequate irrigation facilities is the fourth constraints with the mean score of 45.7. Output price fluctuations were the fifth major constraints in hybrid variety of paddy cultivation with the mean score of 44.7. In hybrid variety of paddy cultivation

Table - 4 : Constraints of hybrid variety of paddy cultivation

Problems	Percent Position	Garrett Value	Mean Score	Rank
High Fertilizer Consumption	10	75	56.8	1
Managerial Skill Labour	30	60	54.9	2
High Cost of Seed	50	50	50.7	3
Inadequate Irrigation Facilities	70	40	45.2	4
Output Price Fluctuations	90	25	44.1	5

used of FYM was higher than local variety of paddy production. Weed management were also the major problem in hybrid variety of paddy cultivation.

CONCLUSION

The findings of this study demonstrated the perception and constraints for local and hybrid variety of paddy cultivation in Atrauliya block of Azamgarh district, Uttar Pradesh. The major perception and constraints of local variety were identified in study area as low land, low input requirement, poor condition, test and cooking quality, suitability of climatic condition where the major constraints were high incidence of disease and pests, low production , more time consuming, poor grain yield, depends on monsoon. The perception for adoption of hybrid variety were high yield, disease and pest resistance, high nutrients value, high market value where the major constraints for hybrid variety were high fertilizer consumption, requirement of managerial skilled labour, high input cost and output price fluctuation. So here we have some suggestion on discussion with farmers and on study basis.

Suggestions:

Major suggestion received from the respondent side and researcher observations to overcome the mentioned problems are:

- The major inputs particularly seeds, fertilizers, insecticides and irrigation etc. should be made available to the farmers just before the growing period which will be helpful in reducing the cost of cultivation and will increase the production of local and hybrid variety of paddy.
- Price fluctuation/ low selling price after harvesting is the major problem of study area so government should take necessary action through different organizations to control the price system and government should ensure that prize of the paddy remains uniform all round the season.
- Government or local agencies/ KVK should provide the training to paddy growers to create the awareness among the paddy growers regarding technical use production.
- Agencies involved in dissemination the improved scientific technique should organize more practical training programmes in order to increase the knowledge and skill of paddy growers.
- Any agricultural knowledge and new technology farmer should call Kisan Call Center no 18001801551 and IFFCO Kisan Call Centre also provide the farmer regarding agriculture on his number 534351.
- Effort should be made by the government to develop the check dam, irrigation channels and ridges.

REFERENCES

1. Agarwal P.K. and Kumar A. (2017), A socio economic study on pros and cons of SRI method of paddy cultivation in Oramanjhi block of Ranchi district, Jharkhand, *Indian J. Agric. Res.,* 51(1), 74-77.
2. Agarwal P.K., Yadav P., and Mondal S. (2018), Economic Analysis of Cost and Return Structure of Paddy Cultivation under Traditional and SRI Method: A Comparative Study, *International Journal of Agricultural Sciences,* 10(8), 5890-5893.
3. Agarwal P.K., Singh A.H., and Prasad D. (2022), Identification of Constraints and Production and Marketing of Marigold, *Journal of Natural Resource and Development,* 17(1), 85-89.
4. Agarwal P.K., Prajapati B., and Chandra P. (2022), Constraints Faced by The Potato Growers in Production, Storage and Marketing of Potato Crop, *Journal of Natural Resource and Development*, 17(1), 104-108.

Journal of Natural Resource and Development 17 (2) 27-31, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH OF RADISH (RAPHANUS SATIVUS L.) C.V. PUSA RASHMI

Monika Kamal[1], Dharmendra Kumar Singh, Manoj Kumar Singh, Surya Narayan, Vishwanath and Rajendra Prasad

Department of Horticulture, KAPG College, Prayagraj - 211002, (U.P.), India.

Corresponding Author Email : singhdks1977@gmail.com

Received : 08.04.2022 Accepted : 11.06.2022

ABSTRACT

Various treatments showed significant variations in growth parameters such as plant height and number of leaves plant^{-1} of radish. There was a linear increase in plant height at all the stages from 15 DAS to 45 DAS in ascending order. The treatment T6 (1% RDF + 50% (FYM + Poultry manure+ Vermicompost + Neem cake) + PSB + Azotobactor) was recorded significantly maximum plant height. However, the minimum plant height was observed in treatment T8 (Control). The probable reasons for increased plant height may be due to the presence of readily available form of nitrogen through both inorganic and organic sources (Neem cake, FYM, Poultry manure, Vermicompost) where in inorganic source could have exerted positive influence on extended nutrient availability to match the physiological needs of the crop since it is applied in splits, which triggered to produce elevated stature of the growth components. In addition to that integration of Neem cake, FYM, Poultry manure, Vermi- compost might have resulted in beneficial influence of nitrification inhibition and amelioration of soil physical and chemical properties. Each dose of inorganic and organic sources caused significant increase in number of leaves plant^{-1} from 15 DAS to 45 DAS in ascending order. Significantly maximum leaves plant^{-1} was observed under treatment T6 (Azotobactor). However, the minimum was observed in treatment T8 (Control). The probable reasons for enhanced number of leaves might be due to promotive effects of macro and micro nutrients 1 % RDF + 50% (FYM +Poultry manure + Vermicompost + Neem cake) + PSB +from both inorganic and organic sources of nitrogen (Neem cake, FYM, Poultry manure, Vermicompost) on vegetative growth which ultimately lead to more photosynthetic activity. Further, additional amount of phosphorous and other micronutrients such as zinc, copper and iron from Neem cake, Vermicompost might have involved in stimulation of root system through efficient translocation of certain growth stimulating compounds leading to better absorption of nitrogen and other nutrients and their utilization might have improved the number of leaves .

Keywords : *Radish, plant height, number of leaves, neem cake*

INTRODUCTION

Radish (*Raphanus sativus* L.) belongs to the family Crucifereae. It is a popular root vegetable in both tropical and temperate regions. Probably it is native of Europe or Asia. Radish is grown for its young tender fusiform root.

Organic manures are derived from decayed plant/ animal matters and are free from harmful chemicals. Organic manures are extremely advantageous in enriching soil fertility and do not contain any chemicals which are harmful. Organic manures feed the soil and maintain sustainability in the agro-ecosystem. Growing of crops by the package of organic manures brings forth the organic farming which is in vogue today and organic farming could find a new market scope. Organic farming relies on ecological processes, biodiversity and cycles adapted to the local conditions, rather than the use of inputs with adverse effects. It combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. There is a heavy demand for this crop throughout the year. Hence yield has to be increased further more. Organic agriculture mainly focuses on utilization of plant residues and manures in agriculture. The organic manuring has positive influence on soil texture towards increased environmental sensitivity, changing food habits, consumers demand for organic food products and supplements are to be considered.

MATERIALS AND METHODS

The experiment was conducted on "Effect of Integrated Nutrient Management on Growth, Yield and Quality of Radish (*Raphanus sativus* L.)" c.v. Pusa Rashmiwas carried out in Rabi season duringthe year 2021-2022. Experimental designs was Randomized Complete Block Design. Number of treatments were 8.Number of replications were 3.

Detail of Treatments:

Treatment Symbol	Treatment Details
T_1	Neem cake (2.5t/ha)+FYM(20t/ha)+PSB(4kg/ha) + Azotobactor (4kg/ha)
T_2	Neem cake (2.5t/ha)+Poultry manure(5t/ha) + PSB(4kg/ha) + Azotobactor(4kg/ha)
T_3	Neem cake (2.5t/ha)+ Vermicompost(5t/ha) + PSB(4kg/ha) + Azotobactor (4kg/ha)
T_4	Neem cake (2.5t/ha)+PSB(4kg/ha) + Azotobactor(4kg/ha) + 50% FYM
T_5	25% FYM + 25%Poultry manure + 25%Vermicompost + 25%Neem
	cake + PSB + Azotobactor
T_6	50% Recommended dose of Fertilizers + 50% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + Azotobactor
T_7	75% Recommended dose of Fertilizers + 25%(FYM + Poultry manure + Vermicompost + Neem cake) + PSB + Azotobactor
T_8	RDF (control)

RESULTS AND DISCUSSION

1. Plant height

Plant height of radish as influence by different treatments is given in Table 1. Plant height was recorded at 15,30 and 45 days after sowing. Plant height increased significantly with the increased crop growth period. At 15 days after sowing, the significantly maximum (1 5. 97cm) plant height was recorded in T_6 (50% RDF + 50% (FYM + poultry manure + vermicompost + neem cake) + PSB + *Azotobactor*), followed by T_7 (75% RDF + 25% (FYM + poultry manure + vermicompost + neem cake) + PSB + *Azotobactor*) (15.69 cm), T_3 (Neem cake 2.5t/ha + Vermicompost 5t/ha + PSB 4kg/ha + *Azotobactor* 4kg/ha) (14.81 cm) and(14.07 cm) and which were at par with each other. While, the minimum (13.09cm) plant height was observed in treatment T_8 (Control).As regards to 30 days after sowing, the significantly maximum (34.57cm) plant height was recorded in T_6 (50% RDF + 50% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*) followed by T_7 (75% RDF + 25% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*) (33.92 cm), T_3 (Neem cake 2.5t/ha + Vermicompost 5t/ha + PSB 4kg/ha + *Azotobactor* 4kg/ha) (32.84 cm), T_1 (Neem cake 2.5t/ha + FYM 20t/ha + PSB 4kg/ha + *Azotobactor* 4kg/ha) (32.71 cm) and which were at Par with each other. While, the minimum (32.05 cm) plant height was observed in treatment T_8(Control). Subramani *et al.* (2011) and Mani and Anu *et al.* (2018) also draw similar conclusions.

Table - 1 : Effect of Integrated Nutrient Management on Plant Height of Radish at 15, 30and 45 Das

Treat. Symb.	*Treatments*	*Plant height (cm) at*		
		15DAS	**30DAS**	**45DAS**
T1	N C(2.5t/ha) +FYM (20t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	14.07	32.71	34.29
T2	N C (2.5t/ha) +P M (5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	13.21	30.11	32.41
T3	N C (2.5t/ha) + VC (5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	14.81	32.84	35.45
T4	N C (2.5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha) +50% FYM	13.77	32.25	32.96
T5	25% FYM + 25% P M + 25% VC + 25% N C + PSB + Azo.	13.31	31.47	32.63
T6	50% RDF + 50% (FYM + P M + VC + N C) + PSB + Azo.	15.97	34.57	36.65
T7	75% RDF + 25% (FYM + P M + VC + N C) + PSB + Azo.	15.69	33.92	36.45
T8	RDF (control)	13.09	32.05	32.08
	S.Em±	(0.320)		
	C.D. at 5% level	(0.981)		
	C.V.	(2.053)		

In case of 45 DAS, treatment T_6 (50% RDF + 50% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*), T_7 (75% RDF + 25% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*) and T_3 (Neem cake 2.5t/ha + Vermicompost 5t/ha + PSB 4kg/ha + *Azotobactor* 4kg/ha) were recorded significantly maximum 36.65, 35.45 and 35.45 cm plant height, respectively and which were at par with each other. However, the minimum (32.08cm) plant height was observed in treatment T_8 (Control). findings are in conformity with the findings of Sentiyangla *et al.* (2010), Uddain *et al.* (2010)

2. Number of leaves plant^{-1}

Number of leaves plant^{-1} of different treatments is given in Table .2. Number of leaves plant^{-1} was recorded at 15, 30 and 45 days after sowing.

Table - 2 : Effect of Integrated Nutrient Management on Number of Leaves Plant^{-1} of Radish at 15, 30 and 45 Das

Treat. Symb.	Treatments	No. of leaves plant^{-1} at		
		15DAS	30DAS	45DAS
T_1	N C(2.5t/ha) +FYM (20t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	6.71	10.61	12.30
T_2	N C (2.5t/ha) +P M (5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	6.47	10.13	11.62
T_3	N C (2.5t/ha) + VC (5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	6.98	11.67	12.55
T_4	N C (2.5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha) + 50% FYM	6.67	10.52	12.23
T_5	25% FYM + 25% P M + 25% VC + 25% N C + PSB + Azo.	6.43	10.20	11.77
T_6	50% RDF + 50% (FYM + P M + VC + N C) + PSB + Azo.	7.34	12.34	13.89
T_7	75% RDF + 25% (FYM + P M + VC + N C) + PSB + Azo.	7.33	11.97	12.62
T_8	RDF(control)	6.35	8.43	11.48
	S.Em±	(0.292)		
	C.D. at 5% level	(0.895)		
	C.V.	(5.088)		

Number of leaves plant^{-1} increased significantly with the increased crop growth period. At 15days after sowing, the significantly maximum (7.34) leaves plant^{-1} was recorded in T_6 (50% RDF + 50% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*) at par with T_7 (75% RDF + 25% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*) (7.33), while, the minimum (6.35) leaves plant^{-1} was observed in treatment T_8(Control).

In case of 30 DAS, the significantly maximum (12.34) leaves plant^{-1} was recorded in T_6 (50% RDF + 50% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*) at par with T_7 (75% RDF + 25% (FYM + poultry manure + vermicompost + neem cake) + PSB + *Azotobactor*) (11.97) and T_3 (Neem cake 2.5t/ha + Vermicompost 5t/ha + PSB 4kg/ha + *Azotobactor* 4kg/ha) (11.67), while, the minimum (8.43) leaves plant^{-1} was observed in treatment T_8 (Control). Swati Brinjh *et al.* (2014), Khalid *et al.* (2015), Randy (2016) and Mani and Anu *et al.*(2018).

At 45 DAS, significantly maximum 13.89 leaves plant^{-1} was observed under treatment T_6 (50% RDF + 50% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*)

followed by T_7 (75% RDF + 25% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*) (12.62) and T_3 (Neem cake 2.5t/ha+ Vermicompost 5t/ha + PSB 4 kg/ha + *Azotobactor* 4kg/ha) (12.55) as compared to other treatments. However, the minimum (11.48 leaves plant^{-1}) was observed in t reatment T_8 (Control). Similar results have been reported by Singh *et al*. (2007), Bairwa *et al*. (2009), Uddain *et al*. (2010), Subramani *et al.* (2011)

REFERENCES

1. Anu, P. M. and Anburani, A. (2018) Organic nutrient management technique for enhancing growth and physiological parameters in radish (*Raphanus sativus* L.) J. Phytol. (2018), (10): 40-42.
2. Bairwa, H. L.; Mahawer, L. N.; Shukla, A. K.; Kaushik, R. A. and Mathur, S. R. (2009). Response of integrated nutrient management on growth, yield and quality of okra (Abelmoschus esculentus). Ind.J. Agri. Sci., 79(5): 381-384.
3. Khalid, M.; Yadav, B.K. and Yadav, M.P. (2015). Studies on the effect of integrated nutrient management on growth and yield attributes of radish (Raphanus sativus L.). Ann. of Hort. 8 (1): 81-83.
4. Randy, E. (2016). Growth and yield performance of radish (Raphanus sativus) cv Snow white in response to varing level of vermicast application.Int. J.Sci. Res. publication, 10 (1): 329-332.
5. Sentiyangla, Kanaujia, S. P.; Singh, V. B. and Singh, A. K. (2010). INM for quality production of radish. (Raphanus sativus L.) in acid Alfisol. J. Soils and Crops, 20 (1): 1-9.
6. Singh, A.; Singh, J. and Singh, K.P. (2007). Response of carrot to organic manures and biofertilizers. Ind. J.
7. Hort., 61 (3): 278 - 279.
8. Subramani, A.; Anburani, A. and Gayathiri, M. (2011). Response of Growth Parameters of Radish (*Raphanus sativus* L.) to various organic nutrients and biostimulants, Asian J. Hort., 6 (1) : 32-34.
9. Swati, B.; Sanjay, K.; Devendra, K. and Manoj, K. (2014). Effect of integrated nutrient management on growth, yield and quality in onion cv. Pusa Madhvi Plant Archives, 1 (14): 557- 559.
10. Uddain, J.; Chowdhury, S. and Rahman, M.J. (2010) Efficacy of different organic manures on growth and Productivity of Radish (Raphanus sativus L.) Int. J. Agri. Environ. & Biotech. Vol.3 No. 1 June.2010Integrated nutrient management on Productivity of carrot and fertility of soil. SAARC. J. Agri., 11(2): 173-181

Journal of Natural Resource and Development 17 (2) 32-36, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

AN ECONOMIC ANALYSIS OF WHEAT CULTIVATION IN LAKHIMPUR KHERI, DISTRICT, U.P.

Prem Chandra[1], Ajay Kumar Varma[2] and Punit Kumar Agarwal[3]
Department of Agricultural Economics,
KAPG College, Prayagraj - 211002, (U.P.), India
E-mail : punitagriculture@gmail.com

Received : 28.05.2022 Accepted : 30.06.2022

ABSTRACT

Wheat is world's most widely cultivated staple food crop being grown since pre historic period and being consumed in various forms by more than one thousands million people in the world .Wheat plays an important role in shaping agriculture and food security mission. India is today the second largest wheat producer in the whole world. Various studies and researches show that wheat and wheat flour play an increasingly important role in the management of India's food economy. India accounts for 13.43 per cent of global wheat area 29.55 million hectare, 12.96 per cent of global wheat production 101.29 million tonnes and is the second largest producer of wheat after China. Uttar Pradesh is the largest wheat producing state in India, followed by Punjab, Haryana and Madhya Pradesh. More than 30 per cent of area and production of wheat in India is by Uttar Pradesh state alone. Hundred (100) samples were taken from Nighasan block of Lakhimpur Kheri district U.P. The highest cost of cultivation was observed on large farms followed by medium, small and marginal farms respectively.

Keywords : *Cost of cultivation, input-output ratio, gross income, wheat production, and food economy.*

INTRODUCTION

In India, Wheat is grown from 11 degree North to 30 degree North latitude and from sea level up to elevation of 3658 meters in the Himalayas. It is grown in a wide range of temperature and annual rainfall, from sandy loam soil to heavy black cotton clay soils (Chatterji, 1966). The adoptability of wheat crop for cultivation in various climatic regions, the ease of storage and the ability to easily convert the grain to flour are the major factors that made wheat the most popular crop cultivated across the globe. At present wheat occupies the largest area under cultivation 220 million hectare than any other crop and its world trade is greater than all other crops combined.

India accounts for 13.43 per cent of global wheat area (29.55 million ha), 12.96 per cent of global wheat production (101.29 million tonnes) and is the second largest producer of wheat after China. Demand of India's wheat in the world shows a raising trend. The country has exported 226.23 million of wheat to the world for the worth of `.424.94 crores / 60.55 USD Millions during the year of 2018-19 (Sendhil *et al*. 2019). Uttar Pradesh is the

largest wheat producing state in India, followed by Punjab, Haryana and Madhya Pradesh. More than 30 per cent of area and production of wheat in India is by Uttar Pradesh state alone. Though Uttar Pradesh is leading in area and production of wheat, its productivity is not the highest, and is less than the national average (Balaganesh*et al*. 2019). Being the highest producer of wheat in the country, growth and stability of wheat production in Uttar Pradesh has higher significance. Also, since agriculture is the main source of livelihood to majority of population in Uttar Pradesh where wheat accounts for highest share in gross cropped area, understanding the growth and instability scenario of wheat and the driving forces behind it in the state is of utmost importance. World trade in wheat is greater than for all other crops combined. Demand of India's wheat in the world shows a rising trend. The country has exported 2, 17,354.22 million of wheat to the world for the worth of `. 439.16 crores/61.84 USD millions during the year of 2019-20.

MATERIALS AND METHODS

Lakhimpur Kheri district of Uttar Pradesh was selected purposively to avoid the inconvenience of investigation and A list all 15 block falling under Lakhimpur Kheri District of U.P. was prepared and one block namely Nighasan was selected randomly. 5 villages were selected randomly for the study. Sample was 100.A number of cost concepts such as cost A_1, A_2, B_1, B_2, C_1, C2 and C_3 are used in the analysis. The input items included under each category of cost are given below-

Cost A_1=

- Value of bullock.
- Value of machine labour.
- Value of seed.
- Value of manures and fertilizers.
- Value of insecticides, pesticides & weedicides.
- Irrigation charge.
- Interest on working capital.
- Depreciation on implements and farm buildings.`.Land revenue.
- **Cost A_1 /A_2** = Cost A_1 + rent paid for leased in land.
- **Cost B_1** = Cost A_2 + Interest on owned fixed capital (excluding land).
- **Cost B_2** = Cost B_1 + Rental value of land.
- **Cost C_1** = Cost B_1 + Imputed value of family labour.
- **Cost C_2** = CostB_2 + Imputed value of family labour.
- **Cost C_3** = Cost C_2 + 10 per cent of cost C_2**Income concepts:**
- **Gross income :-** value of farm output (main product and by product) whether sold or utilized by the family
- **Net income :-** Net income = Gross income - cost C_3
- **Family labour income :-** Family labour income = Gross income - cost B_2
- **Farm business income :-** Farm business income = Gross income - cost A_1/A_2
- **Farm investment income :-** Farm investment income = form business income - imputed value of family labour.

RESULTS AND DISCUSSION

The per hectare costs on various input factors in wheat cultivation was worked out and presented in the table 1 It is revealed from the table that on an average per hectare cost of cultivation of wheat was `.39355.82. It was found highest on large size of farms i.e. `.46045.32 followed by medium size of farms i.e.`.45367.66, small farms `.39743.39, marginal Farmers `.37800.26. The total costs on large farms were maximum because of heavy expenditure on total working capital, human labour, and rental value of land. The further distribution of costs on overall average shows the maximum

expenditure on total working capital i.e., 65.66 per cent of the total cost followed by the expenditure on human labour 22.54 per cent rent value of land 22.09 per cent, Family Labour 13.86 per cent, manure fertilizer 12.75 per cent, machinery charges 10.08 per cent, hired labour 7.03 per cent, irrigation charges 6.62 per cent, seed cost 6.61 per cent, interest on fixed capital 4.25 per cent and bullock/tractor power 3.39 per cent, plant protection 1.32 per cent, interest on working capital 1.00 per cent, respectively.It is depicted from the table that, on average total cost of cultivation (C_3) came to `.39335.24 Per hectare which was maximum to `.46045.32 on large farms followed by medium, small and marginal farms corresponding to `.45369.66, `.39613.39 and `.37800.26, respectively. The cost of cultivation per hectare was maximum on medium sample farms due to more expenditure occurred on human labour and seed as compared to other categories of farms. It was also observed from the table that cost of cultivation had no certain relationship with the farm size, as it was maximum on medium farms followed by small and marginal size group of farms. Income of wheat production were calculated and are given in table 1 per hectare gross income was observed maximum under small farms i.e. `.83657.00 Followed by marginal farm `.80705.00, medium farms `.80104.00 and large farms `.79915.00 respectively. Per hectare gross income was highest on small farms due to higher investment on H.Y.V. seed resulted higher productivity. Productivity on these farms might be due to better management followed by the farmers. On an overall average, gross income came to `.81071.71 where as average net income was `.41736.46 per hectare. On an overall average, farm business income, farm investment income and family labour were worked out to be `.60299.28,

Table - 1 : Per hectare cost of cultivation of different inputs used in wheat. (`./ha.).

S. No.	Particular	Size group of sample farmers				Overall Average
		Marginal	Small	Medium	Large	
1.	Human labour	8600.00 (22.75)	8765.00 (22.05)	10020.00 (22.08)	10426.00 (22.64)	8873.90 (22.54)
a.	Family Labour	5310.00 (14.04)	5440.00 (13.68)	6000.00 (13.22)	6300.00 (13.68)	5456.20 (13.86)
b.	Hired Labour	3290.00 (8.70)	3325.00 (8.36)	4020.00 (8.86)	4126.00 (8.96)	2769.21 (7.03)
2.	Bullock/Tractor	1700.00 (4.49)	2200.00 (5.53)	3010.00 (6.63)	3600.00 (7.81)	1336.02 (3.39)
3.	Machinery charges	4110.00 (10.87)	4320.00 (10.86)	4405.00 (9.70)	4560.00 (9.90)	3970.55 (10.08)
4.	Seed cost	2540.00 (6.71)	2690.00 (6.76)	2760.00 (6.08)	2810.00 (6.10)	2601.70 (6.61)
5.	Manure & fertilizer	5120.00 (13.54)	4930.00 (12.40)	4710.00 (10.38)	4605.00 (10.00)	5018.75 (12.75)
6.	Irrigation charges	2500.00 (6.61)	2640.00 (6.64)	2990.00 (6.59)	3123.00 (6.78)	2607.45 (6.62)
7.	Plant protection	510.00 (1.34)	550.00 (1.38)	530.00 (1.16)	570.00 (1.23)	521.60 (1.32)
8.	Total working capital	25080.00 (66.34)	26095.00 (65.65)	28425.00 (62.65)	29694.00 (64.48)	25841.05 (65.66)
9.	Interest on working capital	376.20 (1.00)	391.42 (1.00)	426.37 (1.00)	445.41 (1.00)	387.61 (1.00)
10.	Rental value of owned land	7276.37 (19.24)	7812.50 (19.65)	10526.31 (23.20)	10362.69 (22.50)	8695.65 (22.09)
11.	Interest on fixed capital	1631.31 (4.31)	1831.44 (4.60)	1865.65 (4.11)	1357.29 (2.94)	1675.41 (4.25)
12.	Sub total	34363.88 (90.90)	36130.36 (90.90)	41243.33 (90.90)	41859.39 (90.90)	35778.03 (90.90)
13.	10% cost managerial of sub total	3436.38 (9.09)	3613.03 (9.09)	4124.33 (9.09)	4185.93 (9.09)	3577.79 (9.09)
	Grand total	**37800.26 (100)**	**39743.39 (100)**	**45367.66 (100)**	**46045.32 (100)**	**39355.82 (100)**

Table - 2 : Measure of per hectare cost and profit of wheat (`./ha.).

S. No.	Particulars	Cost and farm profit				
		Marginal	Small	Medium	Large	Average
1.	Cost A_1/A_2	20146.20	21046.42	22851.37	23839.41	20772.46
2.	Cost B_1	21777.51	22877.86	24717.02	25196.70	22447.87
3.	Cost B_2	29053.88	30690.36	35243.33	35559.39	30321.83
4.	Cost C_1	27087.51	28187.86	30717.02	31496.70	27883.27
5.	Cost C_2	34363.88	36000.36	41245.33	41859.39	35757.45
6.	Cost C_3	37800.26	39613.39	45369.66	46045.32	39335.24
7.	Productivity (qt./ha)					
a.	Main product qt./ha	35.60	36.71	35.32	35.15	35.72
b.	By- product(qt./ha)	40.37	42.50	40.12	40.32	40.68
8.	Grass income	80705.00	83657.00	80104.00	79915.00	81071.71
a.	Main product	60520.00	62407.00	60044.00	59755.00	51771.31
b.	By-product	20185.00	21250.00	20060.00	20160.00	20340.40
9.	Net return over cost C_1	53617.49	55469.14	49386.98	48418.30	53188.43
10.	Net return over cost C_2	46341.12	47656.64	38858.67	38055.61	45314.25
11.	Net income	42904.74	44043.61	34734.34	33869.68	41736.46
12.	Family labour income	51651.12	52966.64	44860.67	44355.61	50749.87
13.	Farm investment income	51812.42	53687.55	47126.30	45589.66	51285.82
14.	Farm business income	60558.80	62610.58	57253.00	56075.59	60299.28
15.	Cost of production(₹/q)	1726.15	1748.51	2037.43	2086.93	1782.00
a.	Cost C_1	760.88	767.85	869.67	896.06	780.72
b.	Cost C_2	965.27	980.66	1167.76	1190.87	1001.28
16.	Input-output ratio					
a.	On the basis of cost A_1	1:4.0	1:3.9	1:3.5	1:3.3	1:3.8
b.	On the basis of cost B_1	1:3.7	1:3.6	1:3.2	1:3.1	1:3.9
c.	On the basis of cost B_2	1:2.7	1:2.7	1:2.2	1:2.2	1:2.6
d.	On the basis of cost C_1	1:2.9	1:2.9	1:2.6	1:2.5	1:2.8
e.	On the basis of cost C_2	1:2.3	1:2.3	1:1.9	1:1.9	1:2.2
f.	On the basis of cost C_3	1:2.1	1:2.1	1:1.7	1:1.7	1:2.0

`.51285.82 and `.50749.87 per hectare, respectively. Cost of production per quintal of wheat was computed to be `.1782.00. Average input-output ratio on cost A_1, cost B_1, cost B_2, cost C_1, cost C_2 and cost C_3 were worked out and came to 1:3.8, 1:3.9, 1.2.6, 1:2.8, 1:2.2 and 1:2.0, respectively. Input –output ratio related to cost C_3 was highest on both marginal and small farms 1:2.1 followed by medium and large farms 1:1.7. In respect of cost C_1, input-output 1:2.9 was highest on both marginal and small farms followed by medium farm 1:2.6 and large farms 1:2.5. Cost C_2 input- output ratio 1:2.3 of cost C_2 was highest on both marginal and small farms followed by medium farms 1:1.9 and large farms 1:1.9. In respect to input-output ratio of cost B_2 1:2.7 was found highest on both marginal farms and small farms followed by medium farms 1:2.2 and large farms 1:2.2. Where, in cost B_1 the input- output ratio was highest on marginal farms (1:3.7) followed by small farms 1:3.6, medium farms 1:3.2 and large farms 1:3.1. In respect to input- output ratio of cost A_1 was highest on marginal farms 1:4.0 followed by small farms 1:3.9, medium farms 1:3.5 and large farms 1:3.3 respectively.

CONCLUSION

Keeping the above facts in view the present study entitled "Economic analysis of wheat cultivation in Lakhimpur Kheri District of U.P" will be carried out with the following objective To work out cost and returns and inputs-output relationship on sample farms. Lakhimpur Kheri district of Uttar Pradesh was selected purposively to avoid the inconvenience of investigation. A list all 15 block falling under LakhimpurKheri District of Uttar Pradesh by area under wheat. The one block namely Nighasan was purposively selected for study from five selected village 100 farmers were selected. On an overall average cost of cultivation of wheat was `.39355.82. Cost $A_{1,}$ cost $B_1$, cost $B_2$, cost $C_{1,}$ cost $C_2$ and cost $C_3$ was highest under a large size of sample farms. overall average cost $A_{1,}$ cost $B_1$, cost $B_2$, cost $C_{1,}$ cost $C_2$ and cost $C_3$ were worked out to be `.20772.46, `.22447.87, `.30321.83, `.27883.27, `.35757.45, `.9335.24 respectively.Cost of production per quintal was lower on small sized farms. Overall average cost of production per quintal was `.1782.00. It means input have sufficient scope to use more for production . Rest factory of production included in production process where found statistically non- significant that means no further scope for application of these inputs.

REFERENCES

1. Agarwal, P. K. & Banerjee A, (2019). Economic analysis of tomato cultivation in kaandi block of westbengal, India, *Economic Affairs* 64(3), 643-647.
2. Agarwal, P.K., Yadav, P., and Mondal, S., (2018). Economic Analysis of Cost And Return Structure of Paddy Cultivation Under Traditional And SRI Method: A Comparative Study. International Journal of Agriculture Sciences, 10 (8), 5890-5893.
3. Ajmer Singh, Satyavir Singh, Surendra Singh (2008). Economic analysis of wheat production constraints in wheat crop: case of North – West India, Agriculture situation in India. 65 (3) : 145 – 149.
4. AnweshaDey, M. Anoop and YashGautam (2020). Wheat Production in Uttar Pradesh – A Study on the Growth and Instability Over Time, *International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706* Volume 9 Number 3.
5. HirendraYadav, Sudhir Kumar Singh, G. P. Singh and K. K. Singh (2014). An Economics Analysis of Wheat Cultivation in Etawah Districts of Uttar Pradesh, India; *Plant Archives* Vol. 14 No. 1, pp. 393-399.
6. Pushpa, S.K. Srivastava and Punit Kumar Agarwal (2017). Comparative Study on Cost of Cultivation and Economic Returns from Major Crops in Eastern Region of Uttar Pradesh, *International Journal of Agriculture, Environment and Biotechnology* 10(3): 387-399.
7. RR Kushwaha, Ravi Pratap Singh, RR Verma, Ajeet Kumar and Brijesh Kumar Patel (2019).An economic analysis of wheat cultivation in Ballia district of eastern Uttar Pradesh; *International Journal of Chemical Studies* ; 7(3): 2194-2197.
8. Sunil Saini1, Parveen Kumar Nimbrayan, Amar Jeet (2019). An Economic Analysis of Wheat and Paddy Cultivation In Kurukshetra District of Haryana; *Int. Arch. App. Sci. Technol*; Vol 10 [3]: 28-31.

Journal of Natural Resource and Development 17 (2) 37-40, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

EFFECT OF ORGANIC AND INORGANIC FERTILIZERS ON GROWTH YIELD AND SEED PRODUCTION OF SPINACH (BETA VULGARIS L.) VAR. PUSA JYOTI

Karam Singh Rana, Rajendra Prasad, Manoj Kumar Singh, Dharmendra Kumar Singh, Surya Narayan and Vishwanath

Department of Horticulture

Kulbhaskar Ashram Post Graduate Collage, Prayagraj - 211002, (U.P.) India

E-mail : singhkaram129@gmail.com

Received : 03.07.2022

ABSTRACT

A field experiment was laid out to study "Effect of organic and inorganic fertilizers on growth and yield of spinach (Beta vulgaris L.) Var. "Pusa Jyoti" was carried out during Rabi season of the year 2021-2022 at K.A.P.G. College, Prayagraj U.P. The experiment was laid out in a randomized block design (RBD) with 3 replicated 7 treatments .The data were recorded on days required for plant height (cm), no of leaves per plant, leaf area per plant (cm2), length of petiole (cm), leaf yield per plant (gm), leaf yield per plot (kg) , total green yield (q/ha) , moisture content (%) dry matter (%) . The result revealed the superiority of treatment T5 (50% RDF + 50% N through poultry manure) significant improvements in various growth parameter viz., plant height maximum (30.81) , number of leaves per plant maximum (11.10), leaf area per plant (cm2) in the superior T5 (650.30) on 45 DAS over the treatment .

Accepted : 05.08.2022

Keyworlds : *Spinach, palak, growth, yield, organic manures, inorganic manures.*

INTRODUCTION

The Indian spinach (Beta vulgaris L.) is one of the most important leafy vegetable consumed all over the country. It is commonly known as "Palak". It belongs to the family Chenopodiaceae, genus *"Beta"* species *"vulgaris"*. Indian spinach is closely related to Beetroot and Swiss chard. Indian spinach is most probably native of Indo-Chinese region. It is known in China as early as 647 A.D. (Nath, 1976). In India, it is grown on large scale. It is extensively grown in states such as Uttar Pradesh, Punjab, West Bengal, Haryana, Delhi, Madhya Pradesh, Gujrat, Bihar and Maharashtra .

The edible portion of spinach consists of compact rosette of leaves prior to the stock formation. It is cultivated for its fresh and green leaves which become ready for harvest (cuttings) in about 30-35 days, from sowing. Palak leaves are valued for their medicinal properties. The leaves are used in inflammation, paralysis, headache, earache and are remedy for diseases of spleen and liver. The fresh leaves are applied to burn. It also act as mild laxative besides these medicinal values, it neutralizes the acidity produced during digestion of

fatty substances and help to prevent constipation. The edible portion of palak leaves contains: moisture 86.4g, fat 0.8g, protein 3.4g, fiber 0.7g, calories 46, phosphorus 30mg, carbohydrates 6.5 , iron 16.2mg, thiamin 0.26mg, vit. A 9770, riboflavin 0.56mg, nicotinic acid 3.3mg, vit. C 70mg.

MATERIALS AND METHODS

The experiment was carried out during Rabi season, 2021-22 at Horticulture farm, Kulbhaskar Ashram Post Graduate College Prayagraj. There were 7 treatment combinations laid out in Randomized Block Design (RBD) with 3 replication. The treatments viz., T1: RDF (Control), T_2 : 75% RDF + 25% N through vermicompost , T_3 : 50% RDF + 50% N through vermicompost , T_4 : 75% RDF + 25% N through poultry manure , T_5: 50% RDF + 50% N through poultry manure , T_6 : 75% RDF + 25% N through FYM , T_7 : 50% RDF + 50% N through FYM. The variety pusa jyoti was used and maintained 30 cm row to row and 10 cm plant to plant spacing using , 30 kg/ha seed rate ,before sowing seed were treated with biofertilizer viz., Rhizobium culture as per treatment recommendation. Full dose of nitrogen, phosphorus and potash was applied as basal. Five plants were selected randomly from each plot to recorded observation on growth and yield attributing character.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Growth characters :

Plant height (cm)

Date (table 1) show that significantly increment in highest plant height T5 (50% RDF + 50% N through poultry manure),) 30.81cm which was significantly superior over the treatments T_3 (50% RDF +50% N through vermicompost) 30.20cm and T_4 (75% RDF + 25 % N through poultry manure) 29.57cm and T_7 (50% RDF + 50% N through FYM) 28.63cm , T_2 (75% RDF + 25% N through vermicompost) 28.10cm, and T_6 (75% RDF +25% N through FYM) 27.51cm. Lowest plant

Table - 1 : . Effect of Organic and Inorganic Fertilizers on mean Plant Height (cm)

Sr. No.	Treatment	Height of Palak Pplant (cm)				
		30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
T_1	RDF (Control)	22.50	27.10	25.30	25.05	25.30
T_2	75%RDF+25%N through vermicompost	23.35	28.10	26.32	26.05	26.52
T_3	50% RDF+50%N through vermicompost	24.62	30.20	28.67	28.35	29.13
T_4	75%RDF+25%N through poultry manure	24.08	29.57	28.35	27.60	28.41
T_5	50%RDF+50%N through poultry manure	25.35	30.81	29.94	28.81	30.25
T_6	75%RDF+25%N through FYM	22.56	27.51	25.56	25.32	25.85
T_7	50% RDF + 50% N through FYM	23.61	28.63	26.81	26.43	27.64
	SE ±	1.081	1.005	0.9314	1.089	1.104
	CD at 5%	3.265	3.034	2.823	3.306	3.338

Table - 2 : Effect of Organic and Inorganic Fertilizers on mean Number of Leaves

Tr. No.	Treatment	Mean number of leaves per plant				
		30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
T_1	RDF (Control)	10.20	8.26	8.12	8.62	7.40
T_2	75%RDF+25%N through vermicompost	11.35	8.86	8.21	9.02	7.81
T_3	50% RDF+50%N through vermicompost	13.20	10.62	10.51	11.02	9.35
T_4	75%RDF+25%N through poultry manure	13.02	10.35	10.00	9.95	8.75
T_5	50%RDF+50%N through poultry manure	14.32	11.10	10.95	11.51	9.63
T_6	75%RDF+25%N through FYM	10.12	8.50	8.15	8.65	7.44
T_7	50% RDF + 50% N through FYM	12.54	9.15	8.76	9.25	8.37
	SE $\pm$	0.474	0.508	0.686	0.521	0.336
	CD at 5%	1.436	1.530	2.071	1.674	1.015

Table - 3 : Effect of Organic and Inorganic Fertilizers on mean Leaf Area (cm²)

Tr. No.	Treatment	Leaf area per plant (cm²)				
		30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
T_1	RDF (Control)	424.90	372.65	385.74	406.66	351.62
T_2	75%RDF+25%N through vermicompost	451.11	421.68	435.82	425.24	411.85
T_3	50% RDF+50%N through vermicompost	587.41	531.10	546.52	501.32	487.25
T_4	75%RDF+25%N through poultry manure	547.21	492.65	517.61	492.62	470.60
T_5	50%RDF+50%N through poultry manure	650.30	600.64	610.36	547.11	525.52
T_6	75%RDF+25%N through FYM	455.32	472.14	436.23	473.14	450.25
T_7	50% RDF + 50% N through FYM	512.32	472.16	493.56	480.10	450.24
	SE $\pm$	35.618	38.099	37.930	35.870	37.840
	CD at 5%	107.86	115.38	114.86	108.65	114.68

height per plant was observed in the treatment T_1 control (22.50)cm. The better plant height be due to better development and branching of roots which help in uptake of nutrient as well as more availability of nutrients. These findings are in similar line with the findings of Jat et al. (2004), and Waghchauvare (2006) in onion Cv. Phule suvarna.

Number of leaves

Date (table 2) show that significantly increment in highest number of leaves per plant treatment T_5 (50% RDF + 50% N through poultry manure)14.32 which was significantly superior over the treatment T_3 (50% RDF +50% N through vermicompost) 13.20 and T_4 (75% RDF + 25 % N through poultry manure)13.02 and T_7 (50% RDF + 50% N through FYM)12.54 , T_2 (75% RDF + 25% N through vermicompost)11.35, and T_6 (75% RDF +25% N through FYM)10.12 . Lowest number of

leaves per plant was observed in the treatment T_1 control (8.12) . The result obtained in present study are supported by the findings of Subbiah et al. (1982), Subhan (1988) and Yadav (2002) in onion. Similar result have been reported by Cerna (1981) and Shiyou (1999) in chilli and tomato.

Leaf area (cm2)

Date (table 3) show that significantly increment in highest number of leaf area treatment T_5 (50% RDF + 50% N through poultry manure) 650.30cm^2, which was significantly superior over the treatment T_3 (50% RDF +50% N through vermicompost) 587.41cm^2 and T_4 (75% RDF + 25 % N through poultry manure) 547.21cm^2 and T_7 (50% RDF + 50% N through FYM) 512.32cm^2 , T_2 (75% RDF + 25% N through vermicompost) 451.11cm^2 , and T_6 (75% RDF +25% N through FYM) 455.32cm^2 . Lowest number of leaves per plant was observed in the treatment T_1 (351.62cm^2) control . The result obtained in present study are supported by the findings of Khullar and Chahal (1978) in brinjil , Kendre (1993) in cabbage, Sheke et al. (1999) in brinjil .

CONCLUSION

From this study can be calculated from maintained of soil health and sustainable production in spinach application of treatment 50% RDF + 50% N through poultry manure (T5) is better option for growth and yield of spinach.

REFERENCES

1. Sharma, S. K., 1994, Response of nitrogen and spacing on plant growth, seed yield and quality of spinach seed. Annals of Agricultural Research, 15(4) : 462-464.
2. Jana, J. C., Thapu, U. and Maity, T. K., 1999, Green and seed yield of palak (Beta vulgris L. var. bengalensis hort.) as affected by nitrogen fertilization and cutting management. Vegetable Science, 26(1) : 61-6.
3. Rajput, B. P., Mehta, V. B., Chavan, A. S. and Sananse, S. L., 1989, Effect of different levels of nitrogen on yield of Palak (Beta vulgaris L.) varieties under coastal saline conditions. Journal of Indian Society, Coastal Agricultural Research, 7 : 37-40.
4. Karadkhelkar, M.V. (1985). Effect of different levels of nitrogen and FYM in combination on yield and quality of Palak {Beta vulgaris L.) var. All Green. M.Sc. (Agri.) Thesis,MAU, Parbhani.
5. Mallangouda, B., G.S. Sulikeri; B.G. Murthy and N.V. Fatibha, (2011). Effect of NPK, FYM and companion crops on growth yield and yield at component of palak (Beta vulgaris) Adv. Agril. Res. Indian Vol., 3:58-59.
6. Mohd. Rail, P.R. Narwadkar, T. Prabhu and A.K. Sajindranath (2002). Effect of organic and inorganic fertilizer on yield and quality of palak. J. Soil and Crops, 12(2): 167-169.

Journal of Natural Resource and Development 17 (2) 41-47, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

ECONOMICS OF BANANA CULTIVATION IN KAUSHAMBI DISTRICT OF UTTAR PRADESH

Prem Chandra[1], Vivek Singh[2], Punit Kumar Agarwal[3] and Dhyanesh Shukla[4]
Department of Agricultural Economics and Statistics
KAPG College Prayagraj - 211 002, (U.P.), India
E-mail : viveksingh8416@gmail.com

Received : 11.07.2022

ABSTRACT

Banana is the cheapest, plentiful and most nourishing of all fruits. Banana is rich source of energy in the form of sugar and starch. Banana is an essential part of daily diet in more than 100 tropical and sub- tropical countries for 400 million people. They prefer fresh fruits instead of canned products. The present study with the objective to work out the cost and profit measures of banana is carried out in Kaushambi block of Kaushambi district. Survey work was carried out with the sample of 100 farmers in six different villages of the Kaushambi block of Kaushambi district of U.P., were selected purposively and randomly keeping because of having the highest area under Banana cultivation in district Kaushambi and based on the increasing trend in the area under production of banana. The data were analyzed using a basic tabular approach and cost concept. The overall cost of banana cultivation was worked out to be Rs. 284425.27 per hectare was highest for medium Rs. 307798.97 size of holding followed by small Rs. 281416.46 and marginal Rs. 264027.48 size of holding. The B: C ratio which indicates the profitability of investment was observed to be 1:1.84 at the overall level. Banana production is seasonal in nature while its demand is inelastic. This also affects the price fixation.

Accepted : 20.08.2022

Keyword: *Banana cultivation, area, production, productivity, cost of cultivation*

INTRODUCTION

Banana (*Musa paradisica L.)* is one of the most important fruit crops in the world. Banana is one of the oldest fruit known to mankind and also an important food for man. In India, banana is popularly known as "*Kalptaru*" *(A plant with virtue*). In view of World scenario, India has the first position in banana production with an annual output of about 31504.00 million tonnes against other leading producer countries viz. China, Indonesia, Brazil, Ecuador, Philippines, Guatemala, Angola, Tanzania, Costarica, Mexico, Thailand and Colombia. Banana is reported to be grown in 130 countries in the world. The world acreage of banana was 50.07 lakh hectares and production was around 11.67 crore metric tonnes (source: food and

agricultural organization 2020). In Indian scenario, In India during the year 2020-21 area, production and productivity of banana was 924140 hectares, 33061790 metric tonnes and 33.83 Tonnes/hectare respectively. India is largest producer of fruit in the world and banana ranks first in production and third in area among fruit crop. It accounts for 25% of the total area and 26% of the production of fruit. Production is highest in Andhra Pradesh (5838.88 thousand tonnes) followed by Maharashtra (4628.04 thousand tonnes). Within India Maharashtra has the highest productivity of 62.0 metric tonnes/hectares against national average of 33.83 tonnes/hectare. The production is also higher in Andhra Pradesh followed by Maharashtra. In India, banana and plantation are widely grown in both tropical and sub- tropical regions comprising Kerala, Karnataka, Gujarat, Odisha, Bihar, Eastern UP, West Bengal, Assam and North Eastern States with considerable socioeconomic and cultural importance. The other major banana producing States are Karnataka, Gujarat, Madhya Pradesh, Punjab, Andhra Pradesh and Assam. The total cultivated area of banana in India is about 841.40 thousand hectares and 31504.00 thousand metric tonnes production (Source: FAO 2021, agricoop.nic.in). In India Banana positions initial afoot and third in region among organic product crops. It represents 13 % of the absolute region and 33 % of the creation of natural products. Creation is most elevated in geographic region (3924.1 thousand tonnes) trailed by Tamil Nadu (3543.8 thousand tonnes) with in India, Maharashtra has the most elevated potency of 65.70 metric tonnes/hectares. Against public traditional of 30.5tonnes/hectares (source: National Horticultural Board, India 2020). In State and District scenario, Among the production of fruits in Uttar Pradesh the total area and production of fruits were 69670 hectares and 102924 metric tonnes respectively (Source: National Horticulture Board). The production of fruits in Uttar Pradesh, Banana ranks second next to mango. The total area and production of banana fruits in Uttar Pradesh was 8800 hectares and 32454 metric tonnes (Source: National Horticultural Board, 2020-21). Banana production plays an important role in Uttar Pradesh state. Fruit production in Uttar Pradesh contributes 26% of total Horticultural crops. The total area under banana in Kaushambi district was 2500 hectares and 2000 tonnes production, and 518 quintal/ hactare productivity respectively. (Source: District Horticulture Office Kaushambi).

MATERIALS AND METHODS

The methodological procedure adopted for selecting the study area. The detailed methodological framework is described as following like sampling procedure, collection of data and analytical framework and background of study area. The study was based on the input and output data obtained from the farmers in Kaushambi block of Kaushambi district. For selection of farmer's multistage sampling design was employed. In this procedure, at first stage Kaushambi district selected purposively. From Kaushambi district Kaushambi (banana growing) blocks following banana cultivation were purposively selected. The block was selected purposively because of the earlier experience of work in the same block. Then on the third stage, five major banana growing villages Katra, Bajaha Khurrampur, Faridpur sawron, Rampur, Rasoolpur Sukuwara and Rakshwara were selected from Kaushambi block. Ultimately 100 number of farmers were selected proportionally from each category of farmers. Details of the farmers selected for the study, are given in table-1

Table - 1 : Distribution of Sample Banana Growers in Selected Villages

S.No.	Name of village	Size of holding						Total	
		Marginal		Small		Medium			
		T.P.	S.F.	T.P.	S.F.	T.P.	S.F.	T.P.	S.F.
1.	Katra	35	09	25	06	12	03	72	18
2.	Bajaha Khurrampur	40	10	22	05	15	04	77	19
3.	Faridpur Sawron	42	11	18	04	07	02	67	17
4.	Rampur	45	11	16	04	13	03	74	18
5.	Rasoolpur Sukuwara	30	07	13	03	11	03	54	14
6.	Rakshwara	32	08	15	04	09	02	56	14
Total		**224**	**57**	**109**	**26**	**67**	**17**	**400**	**100**

The study based on reference agriculture year 2021-22 and simple tabular analysis pattern was adopted.

Analytical Approach

Estimation of Costs and Returns the farm management, cost concept approach is widely used in India for evaluating crop profitability in production. The cost concepts in brief, are Cost A_1, A_2, B_1, B_2, C_1, C_2, and cost C_3.

COST A_1: This gives the total cash expenses incurred by the owner or operator. It included the following terms of costs.

1- Value of hired human labour.
2- Value of bullock labour.
3- Value of machinery charges (except depreciation).
4- Value of fertilizers and manures.
5- Value of seeds.
6- Value of insecticides, pesticides and weedicide
7- Irrigation charges.
8- Depreciation on farm implements
9- Interest on working capital.
10- Land revenue paid to government.

Cost A_2 = Cost A_1+ Rent paid for leased in land, if any

Cost B_1 = Cost A_1+ Interest on value of owned fixed capital assets.

Cost B_2 = Cost B_1+ Rental value of owned land less land revenue + rent paid for leased in land.

Cost C_1 = Cost B_1+ Imputed value of family labour.

Cost C_2 = Cost B_2+ Imputed value of family labour.

Cost C_3 = Cost C_2+10% of Cost C_2 on account of managerial functions performed by the farmer.

In the present study, the rent paid for leased in land was zero, as none of the sample farmers took land on lease. Hence, cost A_1 and cost A_2 are similar. Rates of Returns over Different Cost Concepts

Gross Income: Yield of main product (in kg/acre) x their prices (Rs.) + Yield of by product (in kg/acre) and their prices (Rs.)

Net Income: Gross Income – Cost C.

Farm Business Income: Gross Income – Cost A_2

Farm Investment Income: Farm business income - wages of family labour

Family Labour Income: Gross Income – Cost B.

Results and Discussion

Measures of costs and returns of banana:-

This section deals with various measures of income and cost for banana on marginal, small and medium farms. The cost of cultivation of banana is demonstrated in the Table-2. From the table it is

observed that the average cost of cultivation of sample farmers were Rs. 224279.71 for marginal categories of farmers, Rs. 244507.80 for small categories of farmers and Rs. 271498.90 for medium categories of farmers. The higher cost of cultivation found on medium categories of farmers as compare to marginal and small categories of farmers because medium categories of farmers incurred extra charges on fertilizer, planting material, plant protection chemicals and hired labour. It is also observed that cost of banana cultivation has an increasing trend with the increasing farm size.

The overall cost of cultivation is observed as Rs. 246772.11. From the table it is clear that under cost of cultivation the maximum cost shared by planting material which is Rs. 47119.00, *i.e.* 25.16 percent of total cost on an average basis. The same cost varies from Rs. 44125 for marginal farmer to Rs. 51182 for the medium farmer. The total labour cost family plus hired shared Rs. 42453.78 i.e. 18.93 percent to total cost of cultivation. The hired labour cost found maximum as is Rs. 30657.32 on average basis. The medium farmers incurred maximum hired labour costs which is Rs. 35800.77 followed by small and marginal farmers which are Rs. 30935.77 and Rs. 25235.84 respectively.

Fertilizers and Manure cost were Rs. 36335.08 on an average basis. The fertilizer & manure cost ranges from Rs. 33103.14 at marginal farmer to Rs. 39663.44 at medium farmer. Plant protection chemicals cost was Rs. 11587.05 on an average basis. The cost of plant protection chemicals and herbicides were incurred Rs. 9800.25, Rs. 11235.35 and Rs. 13725.55 in case of marginal, small and medium categories of farmers respectively. The study found that plant protection chemicals and herbicides cost are increased with the increasing farm size and the same trends is also observed in case of fertilizer and Manure cost. In Banana cultivation propping is an important operation which cost Rs. 18675.30 on an average basis that shares 6.07 percent to total cost. The cost of machine charge is Rs. 11500.40 on an average basis. Interest on working capital cost Rs. 11197.85 on an average basis. The land revenue is observed 18 rupees which is same for all sizes of land holding of sample farmers which a farmers.

Depreciation, rental value of owned land and interest on fixed capital show increasing trends with increasing farm size which are Rs. 6347.70 and Rs. 37333.71 per hectare on an average basis respectively.

Table - 2 : Cost of Cultivation of Banana on Sample Farm (Rs./ha.)

S.No.	Particulars	Marginal	Small	Medium	Overall Average
1	Total human labour	40981.12	42261.12	44119.12	42453.78
A	Family labour	15745.28	11325.35	8318.35	11796.32
B	Hired labour	25235.84	30935.77	35800.77	30657.46
2	Machine charge	8500.15	10500.18	15500.88	11500.40
3	Planting material	44125.78	46049.22	51182.00	47119.00
4	Manures & Fertilizer	33103.14	36238.66	39663.44	36335.08
5	Plant protection	9800.25	11235.35	13725.55	11587.05
6	Irrigation	15725.55	18525.25	22630.15	18960.31
7	Propping	15525.30	18450.35	22050.25	18675.30

S.No.	Particulars	Marginal	Small	Medium	Overall Average
8	Total working capital	167761.29	183260.13	208871.39	186630.93
9	Interest on working capital	10065.67	10995.60	12532.28	11197.85
10	Total variable cost (a)	177826.96	194225.73	221403.67	197828.78
11	Revenue of Land	18	18	18	18
12	Depreciation of implements	6457.42	7875.96	4709.74	6347.70
13	Rental value of owned land	35000.25	37000.75	40000.15	37333.71
14	Interest on fixed capital	4977.08	5387.36	5367.34	5243.92
15	Total fixed cost (b)	46452.75	50282.07	50095.23	48943.33
16	Managerial Cost	22427.97	24450.78	27149.89	24672.21
Grand Total (a+b)		**224279.71**	**244507.8**	**271498.90**	**246772.11**

Different cost on the basis of cost concept at sample farms

Different cost on the basis of cost concept at sample farms in the study area is presented in the Table-3. The overall amount of various cost of cultivation components. It is clearly visible from the above table that maximum cost can be seen at cost C_3 which was Rs. 284425.27 followed by cost C_2, B_2, C_1, B_1 and A_1, A_2 with the amount of Rs. 258568.43, 246772.11, 221234.72, 209438.40 and 204194.48 respectively. Cost A_2 was as same as cost A_1 because no rent paid for leased in land. Total both maximum and minimum cost was higher in case of medium farms followed by small and marginal farms. Maximum cost can be observed at cost C_3 which includes cost C_2 plus 10% of cost C_2 on account of managerial function performed by farmer and the minimum cost can be observed at cost A_1 which includes all actual expenses. It shows the increasing trends with the increasing in farms size.

Table - 3 : Cost of Cultivation of Banana as per Cost Concept at Sample Farms (Rs./ha.).

S.No.	Cost	Size of Land holding			
		Marginal	Small	Medium	Overall
1	A_1	184302.38	202119.69	226131.41	204194.48
2	A_2	184302.38	202119.69	226131.41	204194.48
3	B_1	189279.46	207507.05	231498.75	209438.40
4	B_2	224279.71	244507.80	271498.90	246772.11
5	C_1	205024.46	218832.40	239817.10	221234.72
6	C_2	240024.99	255833.15	279817.25	258568.43
7	C_3	264027.48	281416.46	307798.97	284425.27

Yield, Cost and Returns of Banana at the Sample Farms

The Table-4 represents yield and return of banana. The average yield per hectare was maximum in case of medium farm which was 865.08 qt. followed by small farm 838 qt. and marginal farms 820.02 qt. the overall yield was observed 831.03 qt. on an average basis. The average price of banana was 885 Rs. for all categories of banana farmers. The maximum cost of cultivation occurred in medium farms which was Rs. 279817.25 followed by small and marginal farms as Rs. 255833.15 and Rs. 240024.99 per hectare respectively. Therefore the cost of production per quintal observed minimum in case of marginal farms which was Rs. 292.70 followed by small farms Rs. 305.29 and medium farms Rs. 323.45. This resulted because of medium farm size could more expend in inputs applications, and use of outside labour rather than family labour, which ultimately increased cost of production.

Gross income can be seen higher in case of medium farms which Rs. 765595.8 followed by small and marginal farms with the Rs. of 741630 and Rs. 725717.7 respectively. The net return has been observed maximum in case of marginal farms which is Rs. 485692.71 followed by small farms Rs. 485796.85 and minimum in case of medium farms with the Rs. 485778.55, which resulted because of more amount of cost C in medium farm and minimum in marginal farms.

The benefit cost ratio was maximum for marginal farms with 2:2.02 followed by small farms with 1:1.89 and minimum in case of medium farms with 1:1.73. Increased return from input can be seen in case of marginal farms is maximum due to increased productivity aroused due to minimum cost incurred. Also in small farms, family laboursare more active and farm operations more efficiently, whereas small and medium farms contribution of family labour decreases with increases farm size and more hired labour are to be employed from outside.

Table - 4.8 : Yield, Cost and Returns of Banana at the Sample Farms (Rs./ha.)

S.No.	Particulars	Marginal	Small	Medium	Overall
1	Main Yield (q/ha)	820.02	838.00	865.08	831.03
2	Price (Rs/q)	885	885	885	885
3	Gross Income	725717.7	741630.0	765595.8	735461.55
4	Cost of Production (Rs/q)	292.70	305.39	323.45	311.14
5	Cost of Cultivation (Rs/ha)	240024.99	255833.15	279817.25	258568.43
6	Net Income	485692.71	485796.85	485778.55	476893.12
7	B:C Ratio	1:2.02	1:1.89	1:1.73	1:1.84

CONCLUSIONS

The cost of cultivation shown increasing trend from marginal to large farmer. It due to fact that large size of holding farmer could incured more expenditure on modern farm input like quality of seed, hired labour, manure, fertilizers, plant protection and machine labour charges etc. Farm size-wise analysis of the cost concept of the sample banana growers that indicate increasing trend of cost C_3 with increasing farm sizes. The B:C ratio indicates that the cultivation of banana was more profitable in marginal size of group holdings, than of that small and medium size of group holdings. Non availability of quality planting material was considered as major problems faced by banana growers. Lack of awareness regarding market price of banana was considered as the most important problems faced by the banana growers.

Suggestions for future work:-

- ❖ Planting material selected should be carefully with better quality like (G-9) tissue culture variety of banana to maintain proper plant population and to obtain maximum production of banana.
- ❖ Disease and pest resistant varieties should be grown, and there should be information about regular doses of fertilizers.
- ❖ Farmers should be more interested in extension activities like demonstration, training program, exhibition program etc.
- ❖ Farmers should be knowledge about efficient use of input and resources so as to gain maximum output with minimum cost.
- ❖ Farmers should knowledge about better package and practices of banana cultivation so as to get better productivity of banana.
- ❖ Efficient marketing needed most for banana crop in the study area.
- ❖ Proper acknowledgement of marketing information is needed for marketing of this crop so as to farmers can sell their product with better price.
- ❖ The development of agriculture and Horticulture should work for developing new techniques, latest variety of banana and its proper dissemination should be ensured.

REFERENCES

1. Phulara G., Budha J., Puri C., Pant P., (2020), Economics of production and marketing of banana in Kailali, Nepal, *Food and Agribusiness Management,* 1(1), 43-46.
2. Shrama R., and Kispotta W., (2017). Trends analysis of area, production and productivity of banana- district Kaushambi, Utter Pradesh, *International Journals of Current Advanced Research,* 6(2), 2187-2190.
3. Rede B.H., Ratanaparkhe A.N., Rede G.D., (2021). Economics of Banana Production in Solapur District of Maharashtra, India, *Asian Journal of Agricultural Extension, Economics & Sociology,* 39(11), 451-458.

Journal of Natural Resource and Development 17 (2) 48-53, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

STUDIES ON THE EFFECT OF DIFFERENT ORGANIC MANURES ON GROWTH AND YIELD OF RADISH (RAPHANUS SATIVUS L.) – PUSA SAFED

Jitendra Singh, Manoj Kumar Singh, Vishwanath, Rajendra Prasad, Dharmendra Kumar Singh and Surya Narayan

Department of Horticulture,
Kulbhaskar Ashram Post Graduate College Prayagraj - 211 002, (U.P.), India
Corresponding Author E-mail : manojkumarsingh129@gmail.com

Received : 15.07.2022 Accepted : 19.08.2022

ABSTRACT

The present field experiment entitled "Studies on the effect of different Organic Manures on Growth and Yield of Radish (Raphanus sativus L.) –Pusa Safed " was carried out during Rabi season of the year of 2021-2022 at Kulbhaskar Ashram Post Graduate College Prayagraj U.P. ,The Result and Conclusion of the about experiment are briefly explain here.The experiment was laid out in a Randomized Complete Block Design with Three replication. Each replication consists of 7 Treatments. Treatments viz.- T1 FYM 10 Tonnes/ha. T2 Poultry Manure 2Tonnes/ha. T3 Vermicompost 4Tonnes/ha. T4 Poultry Manure + vermicompost (50% +50%) T5 FYM + Vermicompost (50% +50%) T6 FYM +Poultry Manure (50% +50%) T7 FYM + Vermicompost + Poultry Manure (33%+33%+33%). The data were recorded on days 15,30,45 and maturity stage for Plant height (cm.) ,Number of leaves/Plant . The data recorded highest Plant height under treatment T4 (PM 1Tonnes + VC 2 Tonnes/ha.) at different successive stages at 15,30,45 DAS and Maturity.The data recorded lowest Plant height under treatment T1 FYM 10 Tonnes/ha. And The data recorded highest Number of leaves/Plant under treatment T4 (PM 1 Tonnes + VC 2 Tonnes/ha.) and the data were recorded lowest Number of leaves/Plant under treatment T1 FYM10 tonne/ha.

Keywords : *Radish, pusa safed, plant height, number of leaves, organic manure.*

INTRODUCTION

Radish (Raphanus sativus L.) is the most important root vegetable being grown widely all over the country. Radish is grown both as annual and biennial are belongs to the Genus Raphanus and species sativus. It is originated in Europe Asia. In hindi it is called Mooli.It is mainly cool season crop and popular in both tropical and temperate regions. The fleshy edible portion of the roots develops from both the primary root and hypocotyl. In India ,during 2021 -22 radish was cultivated on 180 thousand hectares with an annual production of 2760 thousand metric tones (Anon,2016). It is cultivated throughtout India ,mostly in W.B. ,M.P. ,Punjab ,Assam , Hariyana , Gujarat and H.P. Radish is the most important and high value

nutritive root crop containing per 100 gm.edible portion as 94.4 g moisture, 3.4g carbohydrate, 0.7g protin,0.1g fat,0.8g fibre and 0.6g minerals. It is a good source of vitamin C (Ascorbic acid) containing 15-40 mg of edible portion and supplies a variety of minerals. Radish is grown for its young tuberous roots which are eaten raw as salad or cooked as a vegetable ,It is relished for its pungent flavours and is considered as an appetizer. Young leaves are cooked as vegetable. Radish has refreshing and depurative properties. Organic manures are derived from decayed plant/animal matters and are free from harmful chemicals. Organic manures are extremely advantageous in enriching soil fertility and do not contain any chemicals which are harmful. Organic manures feed the soil and maintain sustainability in the agro-ecosystem. Growing of crops by the package of organic manures brings forth the organic farming which is in vogue today and organic farming could find a new market scope. Organic farming relies on ecological processes, biodiversity and cycles adapted to the local conditions, rather than the use of inputs with adverse effects. It combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life all involved.

Keeping above points in view the present investigation on :-" Effect of different Organic manure on Growth and Yield of Radish (Raphanus sativus L.)" was under taken with the following objectives : To study the effect of Organic manures on the Growth of Radish.

MATERIALS AND METHODS

A field experiment was conducted during Rabi 2021-22 to study the "Studies on the effect of different Organic Manures on Growth and Yield of Radish(Raphanus sativus L.) Variety –Pusa Safed ". The details of material and methods used and the experimental technique adopted during the course of investigation are described below. The experiment was laid out at the "college farm" K.A.P.G. College Prayagraj, Prof. rajendra Singh(Rajju Bhaiya) University Prayagraj, Uttar Pradesh. This region falls under IV Agro climatic zone of Uttar Pradesh state. The experiment was laid out in a randomized block design with three replication and 7 treatments, Treatment viz., T_1-FYM 10 Tonnes/ha., T_2-PoultryManure2Tonnes /ha,T_3 - Vermicompost4 Tonnes/ha.,T_4-Poultry Manure + Vermicompost (50%+50%), T_5- FYM+ Vermicompost (50%+50%), T_6-FYM+Poultry Manure (50%+50%), T_7- FYM + Vermicompost + Poultry Manure (30%+33%+33%) ,

Growth Parameters:-

Plant height(cm.):- Height of plant was recorded from the base just above the soil surface to top of the plant. The height was recorded at 15DAS,30 DAS, 45 DAS and maturity stage.

Number of leaves/plant :- The number of leaves of selected plants was counted and average was worked out at 15 DAS,30DAS,45DAS and maturity stage.

RESULTS AND DISCUSSION

Plant Height :-The plant height of radish plant as influence by different treatments is given in Table 1. Plant height was recorded at 15,30,45 days after sowing and maturity. The Plant height increased significantly with the increased crop growth period. At 15 days after sowing, the significantly maximum (11.56cm) plant height was recorded in T_4 (PM 1 tonnes + VC 2 tonnes /ha.), followed by T_5 (FYM 5 tonnes+ VC 2 tonnes /ha.) (11.00cm) and T_6 (FYM 5 tonnes + PM 1 tonnes /ha.) (10.35 cm) which were at per with each other. While, the minimum (8.55cm) Plant height was observed in treatment T_1 (FYM10 tonnes /ha.).

In case of 30 DAS, significantly maximum (19.00cm) Plant height was registered in T_4 (PM 1 tonnes + VC 2 tonnes /ha.) and which was at par with

T_5 (FYM 5 tonnes + VC 2 tonnes) (18.48cm), However, minimum (15.48cm) Plant height was observed in treatment T_1 (FYM 10 tonnes /ha.).

As Regards to 45 DAS, the treatments T_4(PM 1 tonnes + VC 2 tonnes /ha.) and T_5 (FYM 5 tonnes + VC 2 tonnes/ha.) exhibited significantly maximum (29.28cm and 28.36cm) Plant height and both were at par with each other. While, treatment T_1(FYM 10 tonnes/ha.) was recorded minimum (23.52cm) Plant height.

At maturity, significantly maximum (38.43cm) Plant height was recorded in T_4 (PM 1 tonnes + VC 2 tonnes/ha.),followed by T_5 (FYM 5 tonnes + VC 2 tonnes/ha.) (37.13cm), T_6(FYM 5 tonnes + PM 1 tonnes /ha.)(36.56cm) and T_7 (FYM 3.33 tonnes + VC 1.33 + PM 0.67 tonnes /ha.) (35.26cm) which were at par with each other. However, minimum(31.66cm) Plant height was observed in treatments T_1(FYM 10 tonnes /ha.)

Table - 1 : Plant height (cm) as affected by different treatments of organic manure.

Treat. Symb.	Treatments	Plant height (cm) at			
		15 DAS	30 DAS	45 DAS	Maturity
T_1	FYM 10 t ha^{-1}	8.55	15.48	23.52	31.66
T_2	Poultry Manure (PM) 2 t ha^{-1}	9.16	16.36	24.03	32.15
T_3	Vermicompost (VC) 4 t ha^{-1}	9.36	16.68	25.07	33.55
T_4	(PM 1 tonnes + VC 2 tonnes ha^{-1})	11.56	19.00	29.28	38.43
T_5	(FYM 5 tonnes + VC 2 tonnes ha^{-1})	11.00	18.46	28.36	37.13
T_6	(FYM 5 tonnes + PM 1 tonnes ha^{-1})	10.35	17.88	27.04	36.56
T_7	(FYM 3.33 tonnes + VC 1.33 tonnes + PM 0.67 tonnes ha^{-1})	9.90	17.10	26.24	35.26
	C.D.				1.133
	SE(m)				0.379
	SE(d)				0.535
	C.V.				3.424

Number of leaves/plant:- The number of leaves/plant of different treatments is given in Table. 2, Number of leaves/plant was recorded at 15,30,45 days after sowing and at maturity. ,The number of leaves /plant of radish increased significantly with the increased crop growth period.

As regards to 15 DAS, the treatments T_4 (PM 1 tonnes + VC 2 tonnes ha^{-1}) was recorded significantly maximum (6.00) number of leaves $plant^{-1}$ followed by T_5 (FYM 5 tonnes + VC 2 tonnes ha^{-1}) (5.35) and T_6 (FYM 5 tonnes + PM 1 tonnes ha^{-1}) (5.22) and which were at par with each other. However, minimum (4.07) number of leaves $plant^{-1}$ was noted in treatmsent T_1 (FYM 10 t ha^{-1}).

At 30 days after sowing, significantly maximum (8.13) number of leaves $plant^{-1}$ was registered in T_4 (PM 1 tonnes + VC 2 tonnes ha^{-1}), followed by T_5 (FYM 5 tonnes + VC 2 tonnes ha^{-1}) (7.58) and T_6 (FYM 5 tonnes + PM 1 tonnes ha^{-1}) (7.43) as compared to other treatments. However, The minimum (6.57) number of leaves $plant^{-1}$ was received in treatment T_1 (FYM 10 t ha^{-1}).

Table - 2 : Number of leaves plant^{-1} as affected by different treatments of organic manure.

Treat. Symb.	Treatments	Number of leaves plant^{-1} at			
		15 DAS	30 DAS	45 DAS	Maturity
T_1	FYM 10 t ha^{-1}	4.07	6.57	10.22	13.18
T_2	Poultry Manure (PM) 2 t ha^{-1}	4.24	6.89	10.86	13.78
T_3	Vermicompost (VC) 4 t ha^{-1}	4.73	7.04	11.24	14.03
T_4	(PM 1 tonnes + VC 2 tonnes ha^{-1})	6.00	8.13	13.14	15.79
T_5	(FYM 5 tonnes + VC 2 tonnes ha^{-1})	5.35	7.58	12.49	15.65
T_6	(FYM 5 tonnes + PM 1 tonnes ha^{-1})	5.22	7.53	12.08	15.29
T_7	(FYM 3.33 tonnes + VC 1.33 tonnes + PM 0.67 tonnes ha^{-1})	5.13	7.24	11.53	14.55
	C.D.				0.415
	SE(m)				0.138
	SE(d)				0.196
	C.V.				2.877

At 45 days after sowing number of leaves plant^{-1} (13.14) was registered significantly maximum in T_4 (PM 1 tonnes + VC 2 tonnes ha^{-1}) which was at par with T_5 (FYM 5 tonnes + VC 2 tonnes ha^{-1}) (12.49). The minimum (10.22) number of leaves plant^{-1} was noted in treatment T_1 (FYM 10 t ha^{-1}).

At maturity, significantly maximum (15.79) number of leaves plant^{-1} was registered in T_4 (PM 1 tonnes + VC 2 tonnes ha^{-1}) and which was at par with T_5 (FYM 5 tonnes + VC 2 tonnes ha^{-1}) (15.65). While, minimum (13.18) number of leaves plant^{-1} was recorded in treatment T_1 (FYM 10 t ha^{-1}).

The plant height was significantly increased by various treatments of organic manure at all the growth stages (i.e. at 15, 30, 45 DAS and at maturity). Significantly maximum plant height was recorded in T_4 (PM 1 tonnes + VC 2 tonnes ha^{-1}) followed by T_5 (FYM 5 tonnes + VC 2 tonnes ha^{-1}) and T_6 (FYM 5 tonnes + PM 1 tonnes ha^{-1}) and which were at par with each other. While, the minimum plant height was observed in treatment T_1(FYM 10 t ha^{-1}). This may be due to application of major and minor nutrients, through different organic manure in various levels, increased the photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improving the plant height.

At 15, 30, 45 DAS and at maturity, the number of leaves plant^{-1} was significantly influenced by the different treatments of organic manure. Maximum number of leaves/plant was registered in T_4 (PM 1 tonnes + VC 2 tonnes ha^{-1}) and which was at par with T_5 (FYM 5 tonnes + VC 2 tonnes ha^{-1}). However, minimum number of leaves plant^{-1} was observed in treatment T_1 (FYM 10 t ha^{-1}). Probable reasons for enhanced more number of leaves, may be due to promotive effects of macro and micronutrients on vegetative growth which ultimately lead to more photosynthetic activities.

CONCLUSION

The plant height and number of leaves plant^{-1} was observed significantly increased by various treatments of organic manure at all the growth stages (i.e. at 15, 30, 45 DAS and at maturity). Maximum plant height and number of leaves plant^{-1} was

recorded with the application of PM 1 tonnes + VC 2 tonnes ha^{-1} (T_4).

The application of poultry manure 1 tonnes + vermicompost 2 tonnes ha^{-1} (T_4) was found significantly superior as compared to other organic manures and recorded maximum growth (viz., plant height, number of leaves $plant^{-1}$,

REFERENCES

1. Ahmad Zahoor , Nawab, Ali, Ahmad , Mushtaq, Sqeed Ul Haq and Ahmed Sohail (2005). Yield and economics of carrot production in organic farming. *Sarhad J. Agriculture*. 21 (3): 357-364.
2. Ahmad Fawad Satari, V. Srinivasa, Devaraju, M. Shivaprasad and M. Ganpathi (2019) Study on growth and Root Yield of Radish (Raphunus sativus Lam.) as influenced by Nutrition, Karnataka India. Int. Curr. Micribiol. App.Sci (2020)9 (8) : 2466-2471.
3. Anu, P. M. and Anburani, A. (2018) Organic nutrient management technique for enhancing growth and physiological parameters in radish (Raphanus sativus L.) J. Phytol. (2018), (10): 40-42)
4. Reddy,T.P.; Padmaja, G. and Rao, P.C.(2011).Integrated effect of vermicompost and nitrogen fertilisers on yield and economics of onion- radish cropping system. *Journal of Research ANGRAU*. 39 (3): 62-65.
5. Reddy, T. P.; Padmaja, G. and Rao, P. C. (2011a). Integrated effect of vermicompost and nitrogen fertilisers on soil urease enzyme activity and yield of onion-radish cropping system. *Indian Journal of Agricultural Research*. **45** (2): 146-150.
6. Schulz, F., Stafflage, Nuphaus, N. and Karalus, W. (2000). Yield and quality of carrot varieties in organic cultivation. *Gemse Munchen*. **36** (1): 26- 28.
7. Singh, H.; Bareliya, P.K.; Singh, J. and Kumar, P. (2018) Effect of intrgrated nutrient management on growth and yield of cabbage (Brassica oleracea var. capitata) J.Pharmacognosy and Phytochemistry 2018; 7(2): 1767-1769.
8. Subedi, S.; Srivastava, A.; Sharma, M.D. & Shah, S.C. (2018) Effect of Organic and Inorganic nutrient sources on growth, yield and quality of radish (Raphanus sativus L.) Varieties. Saarc J. Agri., 16 (1): 61-69.
9. Shanmugasundaram, R. and Savithri, P. (2002). Impact of nitrogen with organics on quality attributes and yield of carrot root (*Daucus carota*). *Advances in Plant Sciences*. **15** (2): 637-639.
10. Sharma, Akhilesh, Sharma, R.P., Sood, Sonia and Sharma, J.J. (2003). Influence of Integrated use of nitrogen, phosphorus, potassium and farmyard manure on the yield attributing traits and marketable yield of carrot (*Doucus carota* L.) under the high hills dry temperate conditions of north western Himalayas. *Indian Journal of Agricultural Sciences*. **73** (9): 500-503.
11. Sittirungsun, T., Dohi, H., Ueno, R., Shiga, Y., Nakamura, R., Horia, H. And Kamada, K., 2001, Influence of farmyard manure on the yield and quality in pac-choi and Japanese radish. *Bull. of Hokkaido Prefectural Agric. Exp. Stat.,* **80**: 11-20.
12. Subbiah, B. V. and Asija, G. L. (1956). A rapid procedure for the determination of available N in soils. *Curr. Sc.* **25**: 256-260.
13. Sunandarani, N. and Mallareddy, K. (2007). Effect of different organic manures and inorganic fertilizers on growth, yield and quality of carrot (*Daucus carota* L.). *Karnataka Journal of Agricultural*

Sciences. 20 (3): 686- 688.

14. T. Shiromin and M.G Kibria (2019) Growth and yield of Leafy Radish (Raphanus sativus L.) CV. Saisai as Affected by Nitrogen from Organic and Inorganic Fertilizer IOSR, Journal of Environmental, Science, Toxicology and Food Technology (IOSR-JESTFT) e- ISSN: 2319- 2402, p-ISSN:2319-2399. Volume 13, Issue 7 Ser. I (July. 2019), PP 45-50. www.iosrjournals.org.
15. Uddain, J., Chowdhury, S. and Rahman, M. J. (2010). Efficacy of different organic manures on growth and productivityof radish (*Raphanus sativus* L.). *Int. J. Agric. Environ. & Biotech*. **3** (1): 1 – 5.
16. Verma, Poonam and Pandey, S.N. (2016). Effect of integrated nutrient management in alluvial soil on growth and biochemical responses of radish. *J. Biol. Chem. Research*. 33 (1): 34 -39.
17. Vijayakumari, B., Hiranmaiyadav, R. and Sowmya, M. (2009). A study on the effect of few eco-friendly manures on the growth attributes of carrot (*Daucus carota* L.). *Journal of Environmental Science & Engineering*. 51 (1): 13-16.
18. Vithwel Kanaujia, S.P. (2013). Integrated nutrient management on productivity of carrot and fertility of soil. *SAARC Journal of Agriculture*. 11 (2): 173- 181.
19. Walkley, A. J. and Black, J. A. (1934). Estimation of organic carbon by chromic acid titration method. *Soil Scienc*e, 37: 29-38

Journal of Natural Resource and Development 17 (2) 54-58 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

STUDIES ON EFFECT OF SOURCE OF NUTRIENTS ON GROWTH OF GARLIC (ALLIUM SATIVAM L.) CV.G-41

Reshu Singh, Manoj Kumar Singh, Dharmendra Kumar Singh, Vishwanath, Surya Narayan, Rajendra Prasad and Vivek Kumar Srivastava

Department of Horticulture and Department of Entomology

K.A.P.G College, Prayagraj - 211 002, (U.P.), India

Corresponding Author E-mail : manojkumarsingh129@gmail.com

Received : 09.07.2022

ABSTRACT

The present field experiment entitled "Effect of source of nutrients on growth ,yield and quality of garlic"(Allium sativam L.) cv. G-41"was carried out during rabi season of the year 2021-2022 at K.A.P.G. College, Prayagraj , (U.P). The result and conclusion of experiment are briefly explained here. The experiment was laid out in randomised block design(RBD)with three replication and 10 treatments viz.T1:100 %RDN through Inorganic fertilizer (80:60:60),T2: 100% RDN through FYM, T3: 100% RDN through vermi compost, T4: 100% RDN through poultry,T5: 50% RDN through Inorganic fertilizer+50% RDN through FYM, T6: 50% RDN through Inorganic fertilizer+50% RDN through FYM , T7: 50% RDN through Inorganic fertilizer+50% RDN through Vermi compost,T8: 25% RDN through Inorganic fertilizer+75% RDN through Vermi compost,T9:50% RDN through Inorganic fertilizer+50% RDN through Poultry manure ,T10: 25% RDN through Inorganic fertilizer+75% RDN through Poultry manure. The data were recorded on 30days, 60days, 90days required for development of different plant heights (cm), number of leaves per plant, length and width of leaves. Plant height differs significantly by different treatment combinations. plant height and number of leaves was recorded significantly superior in treatment T5 containing 50% RDN through Inorganic fertilizer+50% RDN through FYM whereas, minimum plant height in treatment T4 followed by in T10 and T9 respectively. The results of the present investigation revealed that among different source of nutrients tried, application of 50% RDN through Inorganic fertilizer+50% RDN through FYM is found highest in plant height ,number of leaves and lengths and widths of leaves was recorded for growth and development of garlic.

Accepted : 12.08.2022

Keywords : *Garlic, growth, length, leaves, height, width, nutrients.*

INTRODUCTION

Garlic is second most important bulbous annual spice after onion crop. It is very hardy vegetable crop and is grown throughout India. It belongs to the family Alliaceae. It is Native to central Asia and is having a chromosome number 2n=16. It produces hermaphrodite flowers. Garlic produces a group of small bulbs called cloves

covered with thin skin and foliage of garlic is flattened rather than hallow like onion.

It is commonly used as a spice or condiments and it has high nutritive value than other bulbous crops and also used for the medicinal purposes because it contains antibacterial substances Allicin which is colorless and odorless amino acid . It is a powerful drug against Amoebic dysentery. When clove is crushed allicin is formed due to enzymatic reaction of allinase. The principal integrated in allicin is diallyl di sulphide which gives true garlic odor.

Its medicinal value in is also well recognized in the control and treatment of hypertension, worms, germs, bacterial and fungal senses, diabetes, cancer, ulcer, rheumatism etc. It also used to cure against sore eyes and earaches. It reduces cholesterol in blood. The therapeutic value of garlic has attracted the attention of one and all since Vedic era and every Indian home can prescribed garlic based effective treatment for many common ailments, because of its medicinal properties. It is rich in protein, phosphorus, potash, calcium, magnesium and carbohydrates. Ascorbic acid content is very high in green garlic. Garlic can be eaten raw or cooked. They may also be dried/ powder and used in tablets and capsules. Raw garlic cloves can be used to make oil and liquid extracts.

Garlic is an important commercial crop grown through India. Madhya Pradesh is the leading state in garlic production more than 31 % area and the other garlic growing state are Gujarat, Maharashtra, Uttarpradesh, Andhra Pradesh, Orissa, and Rajasthan. It is exported every year to other countries and has become a source of earning foreign exchange.

Nutrient management in garlic production is mainly by application of inorganic fertilizers. Proper application of organic manures, crop residues, green manure, suitable crop rotation, balanced application of fertilizers based on soil-testing is important. This can be achieved through integrated nutrient management.

In vegetable crops excessive amounts of inorganic fertilizers are applied for obtaining the higher yield. The excessive use of chemical fertilizers resulted in deficiency of nutrients other than applied and caused and decline in organic carbon in the soil. Organic inputs are often proposed as alternatives to mineral fertilizers. However organic inputs, crop residues and animal manures cannot meet crop nutrient demand over large areas because of the limited quantities available.

MATERIALS AND METHODS

The experiment was conducted at the Vegetable Research Farm, Prayagraj, Department of Horticulture, K.A.P.G college of Agriculture, prayagraj (U.P.) during rabi season 2021-2.The experiment was laid out in Randomized Block Design with three replications and each replication consisted of ten treatments. All the treatments were randomized separately in each replication.

Data collection

Data collection, a set of 5 random plants from each plot excluding the border plants was taken during the crop growing period. The observations recorded during the crop growing period were plant height (cm), number of leaves per plant, leaf length (cm), leaf breadth (cm).similarly in this way data is collected after harvesting

RESULTS AND DISCUSSION

The experiment, entitled "Effect of source nutrients on growth, yield and quality of garlic *(Allium sativum* L.) Cv. G-41" conducted at College of Agriculture, Prayagraj (U.P.) in rabi season 2021-22, are presented and described in this chapter. The experiment contain 10 treatments contain different level of nutrients, replicated 3 times and were laid down in RBD. Data pertaining to various criteria used for treatment evaluation were analyzed

statistically to test their significance and analysis of variance.

Growth parameters

The observation of plant heights and number of leaves were taken after planting of seedling and data was recorder with in 30, 60 and 90 DAS.

1. Plant height (cm)

Plant height at 30 DAP did differ significantly by different treatment combinations .The result revealed that plant height was recorded significantly superior (38.52 cm) in treatment T5 containing 50% RDN through Inorganic fertilizer+50% RDN through FYM whereas, minimum plant height (31.73cm) in treatment T4 followed by (32.67cm) in T10 and (33.27cm) in T9 respectively.

Plant height at 60 DAP showed significant increase with maximum plant height was recorded in T5 (49.05cm) over rest of the treatments, while minimum plant height (41.53cm) was found in treatment T4 containing 100% RDN through Poultry manure.

The plant height at 90 DAP showed significant increase with maximum plant height was recorded in T5 (52.28cm), over rest of the treatments, while minimum plant height (45.13 cm) was found in treatment T4, followed by (46.28 cm) in treatment T1 & T9, (46.38cm) in treatment T10.

2. Number of leaves plant per plant

Number of leaves at 30 DAP did differ significantly by different treatment combinations. The result revealed that number of leaves was

Table - 1 : Plant height as influenced by source of nutrient management of garlic

Treatment	Plant height (cm)		
	30 DAP	60 DAP	90 DAP
T_1 100%RDN through Inorganic fertilizer	34.39	43.7	46.28
T_2 100% RDN through FYM	36.62	47.1	50.15
T_3 100% RDN through Vermicompost	35.27	45.0	48.28
T_4 100% RDN through Poultry manure	31.73	41.55	45.13
T_5 50% RDN through Inorganic fertilizer+50% RDN through FYM	38.52	49.05	52.28
T_6 25% RDN through Inorganic fertilizer+75% RDN through FYM	36.52	43.9	47.53
T_7 50% RDN through Inorganic fertilizer+50% RDN through Vermi compost	35.27	45.0	49.78
T_8 25% RDN through Inorganic fertilizer+75% RDN through Vermi compost	34.52	44.3	47.43
T_9 50% RDN through Inorganic fertilizer+50% RDN through Poultry manure	33.27	43.1	46.28
T_{10} 25% RDN through Inorganic fertilizer+75% RDN through Poultry manure	32.67	43.5	46.38
S.E(m±)	0.61	0.63	0.71
C.D.@ 5%	1.82	1.87	2.11

recorded numerically maximum (5.35cm) in treatment T5 containing 50% RDN through Inorganic fertilizer+50% RDN through FYM whereas, minimum number of leaves (2.89cm) in treatment T4 containing 100% RDN through Poultry manure. Followed by (3.09cm) in T9 containing 50% RDN through Inorganic fertilizer+50% RDN through Poultry manure.

The number of leaves per plant at 60 DAP showed significant increase with maximum plant height was recorded in T5 (8.40cm) containing 50% RDN through Inorganic fertilizer+50% RDN through FYM over rest of the all treatment, while minimum number of leaves per plant (6.0cm) was found in treatment T4 containing 100% RDN through Poultry manure.

. The number of leaves per plant at 90 DAP showed significant increase with maximum plant height was recorded in T5 (10.40cm) containing 50% RDN through Inorganic fertilizer+50% RDN through FYM over rest of the treatments, while minimum number of leaves per plant (7.80 cm) was found in treatment T4 containing 100% RDN through Poultry manure, followed by (9.80cm) in treatment T2 & T6.

CONCLUSION

The results of the investigation entitled "Studies Effect of source of nutrients on growth yield and quality of garlic *(Allium sativum* L.) cv. G-41" Have shown both that both the quantitative and

Table - 2 : Number of leaves per plant as influenced by source of nutrient management of garlic

Treatment	No. of leaves		
	30 DAP	60 DAP	90 DAP
T_1 100%RDN through Inorganic fertilizer	4.09	7.2	9.2
T_2 100% RDN through FYM	4.75	7.95	9.8
T_3 100% RDN through Vermi compost	4.0	7.0	9.0
T_4 100% RDN through Poultry manure	2.89	6.0	7.8
T_5 50% RDN through Inorganic fertilizer+50% RDN through FYM	5.35	8.4	10.4
T_6 25% RDN through Inorganic fertilizer+75% RDN through FYM	4.6	7.73	9.8
T_7 50% RDN through Inorganic fertilizer+50% RDN through Vermi compost	4.47	7.7	9.4
T_8 25% RDN through Inorganic fertilizer+75% RDN through Vermicompost	4 .2	7.4	9.4
T_9 50% RDN through Inorganic fertilizer+50% RDN through Poultry manure	3.09	6.2	8.2
T_{10} 25% RDN through Inorganic fertilizer+75% RDN through Poultry manure	3.93	6.8	8.8
S.E(m±)	0.12	0.23	0.32
C.D.@ 5%	0.37	0.69	0.97

qualitative characters have positive effects with addition of organic nutrient supplements (i.e. FYM, vermicompost or poultry manure) along with inorganic fertilizers in different treatments when compared with the sole inorganic fertilizer treatments.

On the basis of present investigation it can be concluded that the integration of inorganic fertilizer with 50 % Inorganic fertilizer + 50 % FYM followed by T2 100% RDN through FYM, T7 50% RDN through Inorganic fertilizer+50% RDN through Vermi compost influenced the more growth, yield and quality of garlic (Nitrogen, Phosphorus, Potassium and Sulphur content in bulb).

REFERENCES

1. Anonymous 2011. Garlic area, production and productivity, Directorate of Onion and Garlic Research, (http:www.dogr.res.in)
2. Alam, M.D., Rahim, M.A. and Sultana, M.S. 1999. Effect of paclobutrazole and sulphure fertilizer on the growth and yield of Garlic. *Bangladesh Journal of Training and Development,* 12(1-2): 223-230.
3. Alkaff, H. A., Saeed, O. S. and Salim, A. Z., 2002. Effect of biofertilizer, inorganic, organic and foliar application of Power 4 on the productivity of onion. *Univ. Aden J. Natural and Appl. Sci.*, 6(1): 114.
3. Bhatia, A. K. and Pandey, U. C., 1991. Effect of planting methods, fertility levels and spacing on seed production of kharif onion. Res. Dev. Rep., 8(1): 10-16.
4. Bhagwan Singh Choudhary, Soni, A. K. and Khaswan, S. L. 2013. Growth, yield and quality of garlic (Allium sativum L.) as influenced by different nutrient management practices, Ann. Agric. Res. New Series. 34(3): 210-213.
5. Buwalda, J.G., Frederikson, R.E. (1985). Nitrogen requirements. Newzealand commercial Grower 40(2) : 28
6. Buwalda, j. G., and Freeman, R.E. (1987) Scientia Hort., 32:161-73
7. Castellanos, J.Z., Ojodeagua, J.L. (2002). Potassium requirement of rgarlic under under fertigation. *Better crops international* 16(1):9-11.
8. Cervato,A.(1969) *Ann.Fac. Agrar. S.Cuore. Milano,* 10: 422-41.
9. Damse, D.N, Bhalekar, M.N. and Pawar, P. K. (2014) Effect of integrated nutrient management ongrowth and yield of garlic. *An International Quarterly Journal of Life Sciences. The Bioscan* 9(4):1557-1560
10. Devi, A. K. B., Limi Ado, and Singh, N. G., 2003. Effects of inorganic and biofertilizers on bulb yield and economics of multiplier onion (*Allium cepa* L. var. *aggregatum* Don). News
11. Fikru Tamiru Kenea and Fikreyohannes Gedamu (2018) Response of garlic (*Allium sativum)* to vermicompost and mineral N fertilizer. Appl. *Ethiopia* 13(2):27-35.
12. Gowda, M.C., Vijayakumar, M. and Gowda, A. P. M. 2007. Influence of integrated nutrient management on growth, yield and quality of garlic (Allium sativum L.) cv. G-282. Crop. Res. Hisar. 33: 144-147.
13. Ghawade SM, Patil MJ, Kolhe PP, and Gawande PP. 2011. Influence of planting dates, bio-fertilizers, organic manures on yield and economical returns in garlic. Annals of Plant Physiology. 25(2):156-160.
14. Hamma, I.L, Ibrahim, U. and Mohammed, A.B. (2013) Growth, yield and economic performance of garlic (*Allium sativum*) as influenced by farm yard manure and spacing in Zaria, Nigeria. *Journal of Agricultural Economics Development* 2(1)001-005.
15. Jay Prakesh, Sanjay Kumar, Panday,Vjay Kumar, Verma, Shashank and Verma, V.K. (2017) Effect of the organic manure and inorganic fertilizer on growth and yield of garlic (*Allium sativum*). *Annals of Horticulture* 10(1):95

Journal of Natural Resource and Development 17 (2) 59-69 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

THE PHYSICAL PROPERTIES OF MURRAH, JAFFARABADI SURTI AND MARATHWADI BUFFALO MILK UNDER BUNDELKHAND REGION

U.K. Shukla and Bhakti Mishra
Department of (N.R.M.), Faculty of Agriculture
Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna - 485334, (M.P.), India
E-mail : umeshdr_2006@rediffmail.com

Received : 02.07.2022

ABSTRACT

The present work was under taken to know the physical properties of Murrah, Jaffarabadi, surti and Marathwadi buffalo milk under Bundelkhand region. In all 40 milk buffaloes were selected for collection of milk samples. The buffaloes were selected from Bhalla Dairy Farm Satna and experiment done at Livestock Production and Management (Unit), Department of Natural resource management (NRM), Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot– Satna (Madhya Pradesh). The individual animal was milked completely in milking pain carefully till last strips. Then milk was mixed well and after mixing samples were taken in sample bottles. As soon as samples collected, they were transferred to the laboratory of Department of NRM and kept in refrigerator till analysisis over. All tests were conducted within 5 to 6 hours. Samples were collected from month of March to May 2022. In all three samples from 10 selected Marathwadi buffalo breed. It is concluded that the physical properties of Marathwadi, Murrah, Jaffarabadi and Surti buffalo milk not differ significantly under the conditionof Marathwada regionin respectofit's breed averages.

Accepted : 05.08.2022

Keywords : *Physical properties, buffalo breeds, livestock*

INTRODUCTION

Livestock systems occupy about 30 per cent of the planet's ice-free terrestrial surface area and are a significant global asset with a value of at least $1.4 trillion. The livestock sector is increasingly organized in long market chains that employ at least 1.3 billion people globally and directly support the livelihoods of 600 million poor smallholder farmers in the developing world (Thornton *et al.* 2006).

Keeping livestock is an important risk reduction strategy for vulnerable communities, and livestock are important providers of nutrients and traction for growing crops in smallholder systems. Livestock products contribute 17 per cent to kilocalorie consumption and 33 per cent to protein consumption globally, but there are large differences between rich and poor countries (Rosegrant *et al.* 2009).

Milk obtained from healthy animal's udder

is free from pathogenic bacterial but some of the animals in field condition may be suffering from sub-clinical mastitis and are excreting the causative agent in milk, such milk contaminates the bulk milk. Moreover, fresh milk may get microbial contamination from utensils, animal skin, environment, or water used for cleaning etc. (FAO, 2008).Milk is a nutritious food for humans as well as an ideal growth medium for bacterial pathogens, (Ruusune *et al*., 2013).

The buffalo represents a fundamental and irreplaceable resource for tropical countries. The increase in the number of buffalo heads is mainly due to the increase of River buffaloes (50 n), utilized for milk and meat production, while the Swamp buffaloes (48 n), mainly used as draught animal power, has decreased by 26.69% especially in South-Eastern Asia. The Swamp buffalo in many countries is crossbred with the river type, due to an increase in milk demand. In fact, it is true that the dairy cow is not always able to totally exploit its genetic merit for many months in the tropical areas, due to the high temperatures and high humidity rate. On the contrary, under the same conditions, the River buffalo can still support an optimal production, although, it retains a sensitivity to such environmental conditions. In fact, if nutritive requirements are satisfied, buffaloes are characterized by similar milk productions in both tropical and temperate areas, In the last years, world's buffalo milk percentage has increased from 5 to 14.8%, but such values can bounce from 8.3 to 21.6%, when we consider that buffalo milk is 58% higher in energy than its cattle counterpart, (Misra A.K., 2007).

Dairy Buffalo rearing is one of the most important occupations. It contributes more than 50% of the total milk production in India. Murrah buffalo cow is the finest breed of milk producing buffalo. Introduction of high yielding breed like Murrah buffalo in milk deficient state can bridge the gap of milk requirement in India. There is a huge gap in their rearing or managemental practices, production and reproduction performances and efficient/economical output of their produce in different parts of India. Agro-climatic condition of the regions affects the production and reproduction performances of dairy animals such as the finest breed, Murrah Buffalo. Performance traits like 305-days, peak milk yield, lactation length, dry period, birth weight, calf mortality rate, age at first calving, service period, calving interval, number of services per conception and conception rate of Murrah buffalo were reported as 2147.6 ± 87.06 kg (Pawar HN., 2012). Buffalo is an important dairy animal as it produces more than 50% of the total milk in the country. India is the habitat of rich buffalo genetic diversity and Jaffarabadi is one of the best dairy type buffalo available in the country. Jaffarabadi is a heavy and massive type of river buffalo found in large numbers in Gujarat, especially in Gir forest, the well known sanctuary of Indian lion. The Gir forest reserve is a tough terrain of about 1300 square kilometers covered with open forest which abounds with diverse wildlife. The "Maldhari" herdsmen, who live in family settlements called as "Nesdas" in the forest areas own these buffaloes. Even under such difficult conditions, the Maldhari herdsmen continue to rear buffaloes which is the main source of their livelihood. However, some of the animal breeders with little land holding and professional attitude, do keep these animals in good condition and sound management Jaffarabadi buffaloes are good milkers and thrive well on natural grazing. These buffaloes characteristically differ from other breeds mainly in terms of production, with good genetic potential to produce more in terms of kilofat. They are very efficient in the conversion of roughages into milk with a high butter fat content. Males are good draught animals for hauling Beats

loads, (Basu, 1985).

The Surti is one of the well-defi ned buffalo breeds of India. The home tract of this breed is Central and South-Western part of Gujarat state. The breed is generally found in the Middle Gujarat, the South Gujarat medium rain fall and the South Gujarat heavy rain fall agro-climatic zones of Gujarat state. The breed is known for its sickle shaped horns. The animals of this breed are of medium size. Estimation of genetic parameters is important for elucidating the genetic basis of the trait. Detailed genetic analysis of body weight traits in Surti buffalo maintained on an organized farm help us in identifying various factors affecting the growth of animals. Estimation of genetic parameters for various body weight traits also helps the breeder in identifi cation of various selection criteria and the planning of breeding programs for genetic improvement in Surti buffalo for growth and indirectly for production traits also. As limited information is available on the growth performance of Surti animals on organized farms, the present study was planned with the objective to carry out genetic analysis of birth weight and body weight at different ages up to 12 months and various genetic and non-genetic factors affecting it, (Krishnamoorthy, 1979).

Marathwadi buffaloes constitute a major section of buffalo breeds of Marathwada region of the State of Maharashtra. A sizable buffalo population in Parbhani, Jalna, Beed, Osmanabad, Latur, Nanded and some parts of Buldhana and Akola districts of Vidarbha contribute significantly to the farmers economy. It has not been recognized as a distinct breed and is considered as a local buffalo (Gavaran) in its home tract. In this paper, an attempt has been made to know and establish the legal standards for some physico-chemical parameters of Marathwadi buffalo milk. The comparison is also done between Marathwadi buffalo milk with the milk of other improved breeds in respect of these parameters, (Dubey, 1998).

MATERIALS AND METHODS

Duration and Place of Study

The present work was undertaken to know the physical properties of Murrah, Jaffarabadi, surtiand Marathwadi buffalo milk under Bundelkhand region. In all 40 milk buffaloes were selected for collection of milk samples. The buffaloes were selected from Bhalla Dairy Farm Satna Livestock Production and Management (Unit), Department of Natural resource management (NRM), Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot–Satna (Madhya Pradesh).

Collection of milk samples

The milk samples were collected at the rate of 5-10 samples daily in the morning and evening milking from Bhalla Dairy Farm Satna and experiment of milk on Livestock Production and Management (Unit), Department of Natural resource management (NRM), Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot–Satna (Madhya Pradesh). The particular buffalo was identified on the basis of morphological characters and then milk samples were collected from each and every animal which were in milk during the period of investigation. The individual animal was milked completely in milking pail carefully till last strips. Then milk was mixed well and after mixing samples were taken in sample bottles. As soon as samples collected, they were transferred tothe laboratory of Department of NRM and kept in refrigerator till analysis is over. All tests were conducted within 5 to 6 hours. Samples were collected from month of March to May 2022. In all three samples from 10 selected Marathwadi buffalo breed.

Analysis

Collected with sample swere analysed for physical and chemical properties as indicated blow:

- Chemical composition
- Specific gravityTitratable
- acidity
- pH
- Electrical conductivity Viscosity
- Refractive index

Methodology for analysis of milk samples

Physical properties

Specificgravity (Lactometer reading)

Specific gravity of milk was determined by using Zeal lactometer as per IS :1183, (1965). The milk sample was warmed to 40- 45 0 C for 5 minutes thenwater cooled to 20 ° C ± 2 ° C and held within this range until the density reading is taken. The sample was poured into ajara long the side of jarso as to avoid incorporation of air. Sufficient milk was poured into jar to ensure that some of it over flowed when the hydrometer was inserted. The lactometer held by the top of the stem was inserted in the sample and released when approximately in its position of equilibrium thus avoiding wetting more than a very short length of the stem above the milk surface. soon as hydrometer was at rest, the scale reading corresponding top of them eniscus of milk was noted.

Acidity

As per the method in IS:1479 Part-I(1960)

pH

Jackson (1967) procedure was used to trend the pH values of milk.

Electrical Conductivity

The electrical conductivity of milk was determined by digital conductivity meter (type MCD-287). A well mixed sample was placed in such a way thatthe electrode was completely dipped in the milk. The conductivity meter was calibrated at100 at 25oc and then taken a reading at milk temperature.

Viscosity

Viscosity ofmilk sample was determined byusing Ostwa l d's Viscometer as per Yadav and Roy (1969). The clean dry viscometer was fixed in constant temperature of 20 °C , so that marking above the bulb remained below the water surface. Transfer 20 ml of distilled water to fill about two thirds of the viscometer bulb. Attach a soft rubber tubing to the arm of the viscometer containing marked bulb and draw distilled water over the upper mark. Close rubber tube with fingers and re l ease pressure slowly to allow the water to flow down. Start the stop watch when the meniscus of water just leaves the upper mark and measure the time for meniscus to reach the lower marking. Take out viscometer , drain out water and dry it by drawing dust free air. Replace viscometer to bath and repeat experiment as above with the milk sample. Measure the density of milk sample relative to distilled water used in experiment.

Refractive Index

There fractive index of milk was determined by using Abbe's refractometer. There fractive index of milk was measured according to the A.O.A.C. (1955). The 7.25 per cent strength of copper sulphate solution was used for the preparation of milk serum. It was prepared by dissolving 72.5gm of CuS04.5H2O in 1000ml of distilled water. The solution had specific gravity of about 1.0443 at 20° candrefractive index of 1.34124. Serum of the sample was prepared by adding 5ml of copper sulphate solution to 20ml of milk. The curd was separated from the serum by filtration through What man filter paper No. 42. The refraction was read for serum at 20°C. The refractometer showed the circular patch of light into adarksemi-circle at the top and bright one at the bottom. At this poin treading was directly note dont head jacentre fractive index scale.

Statistical Analysis of Data:

The data recorded during the course of investigation was subjected to statistical analysis by "Analysis of variance technique". The significant andnon-significant treatment effects were judged with the help of „F (varianceratio) table. The significant differences between theme answere tested against the critical difference at 5% probability level. For testing the hypothesis, the following ANOVA table wa sused.

RESULTS AND DISCUSSION

Specific Gravity

The higher average specific gravity observed in milk of Murathwadi buffalo(1.061) followed by Jaffarabadi (1.061) and Murrah (1.061) and lower in Surti (1.060). The differences observed in the specific gravity of milk of these four breeds were non-significant. It indicated that the specific gravity of these four breeds was nearly close to each other.

Table - 1.0 : Specific gravity of milk of different buffalo breeds

Replication		Marathwadi	Murrah	Jaffarabadi	Surti	Mean
R1		1.063	1.057	1.064	1.057	1.060
R2		1.065	1.061	1.062	1.063	1.063
R3		1.060	1.059	1.059	1.062	1.060
R4		1.062	1.059	1.059	1.062	1.061
R5		1.060	1.062	1.061	1.058	1.060
R6		1.060	1.062	1.062	1.058	1.061
R7		1.061	1.058	1.062	1.059	1.060
R8		1.059	1.061	1.059	1.060	1.060
R9		1.058	1.057	1.060	1.056	1.058
R10		1.062	1.064	1.058	1.061	1.061
Range	Max	**1.065**	**1.064**	**1.064**	**1.063**	**1.063**
	Min	**1.058**	**1.057**	**1.058**	**1.056**	**1.058**
	Mean	**1.061**	**1.060**	**1.061**	**1.060**	**1.060**
		Result	S. Ed. (±)		C.D.at 5%	
Replication		NS	0.001		0.002	
Cow		NS	0.001		0.003	

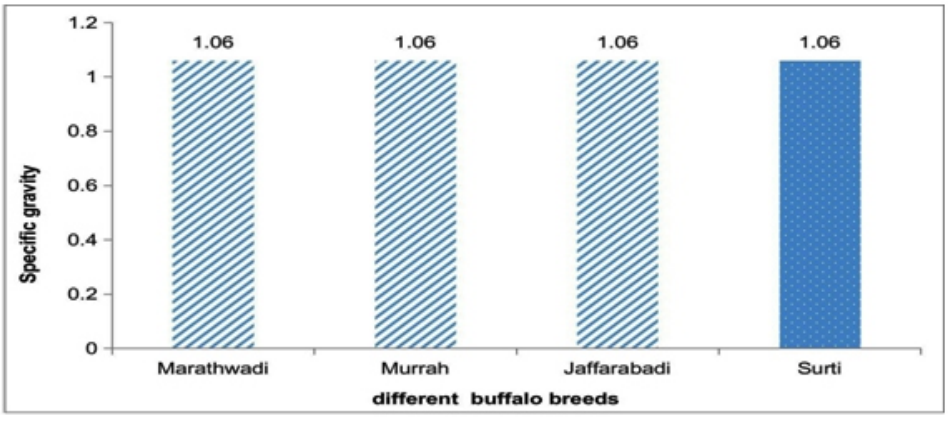


Fig. - 1.0 : Specific gravity of milk of different buffalo milk

Acidity

The higher average Acidity observed in milk of Murathwadi buffalo (0.19)followed by Murrah, (0.19) and Jaffarabadi (0.19) and lower in Surti (0.19).The differences observed in the Acidity of milk of these four breeds werenon-significant. It indicated that the Acidity of these four breeds was nearlycloseto eachother.

Table - 2.0 : Acidity of milk of different buffalo breeds

Replication		Marathwadi	Murrah	Jaffarabadi	Surti	Mean
R1		0.19	0.18	0.19	0.18	0.18
R2		0.19	0.19	0.19	0.18	0.19
R3		0.19	0.19	0.19	0.19	0.19
R4		0.19	0.19	0.19	0.20	0.19
R5		0.18	0.19	0.19	0.18	0.19
R6		0.18	0.19	0.18	0.18	0.18
R7		0.20	0.18	0.18	0.18	0.18
R8		0.19	0.19	0.19	0.19	0.19
R9		0.18	0.20	0.19	0.20	0.19
R10		0.19	0.20	0.18	0.18	0.19
Range	Max	**0.20**	**0.20**	**0.19**	**0.20**	**0.19**
	Min	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**
	Mean	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**
		Result	S. Ed.(±)		C.D. at5%	
Replication		NS	0.002		0.005	
buffalo		NS	0.004		0.008	

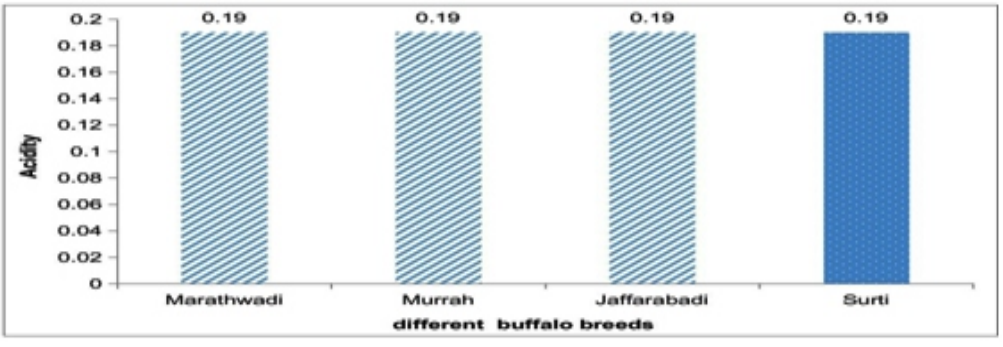


Fig. 2.0 Acidity of milk of different buffalo milk

pH

The higher average pH observed in milk of Surti buffalo (6.84) followed by Murrah, (6.81) and Jaffarabadi (6.81) and lower in Murathwadi (6.71). The differences observed in the pH of milk of these four breeds were non-significant. It indicated that the pH of these four breeds was nearly close to each other.

Table - 3.0 : pH of milk of different buffalo breeds

Replication		Marathwadi	Murrah	Jaffarabadi	Surti	Mean
R1		6.71	6.75	6.73	6.78	6.74
R2		6.74	6.87	6.97	6.80	6.85
R3		6.86	6.76	6.68	6.84	6.79
R4		6.60	6.74	7.04	6.86	6.81
R5		6.82	6.94	6.75	6.88	6.85
R6		6.67	6.90	6.81	6.84	6.81
R7		6.64	6.77	6.77	7.04	6.81
R8		6.79	6.88	6.82	6.76	6.81
R9		6.57	6.66	6.70	6.77	6.68
R10		6.67	6.80	6.85	6.80	6.78
Range	Max	**6.86**	**6.94**	**7.04**	**7.04**	**6.85**
	Min	**6.57**	**6.66**	**6.68**	**6.76**	**6.68**
	Mean	**6.71**	**6.81**	**6.81**	**6.84**	**6.79**
		Result	S.Ed. (±)	C.D.at5%		
Replication		NS	0.042	0.086		
buffalo		S	0.066	0.136		

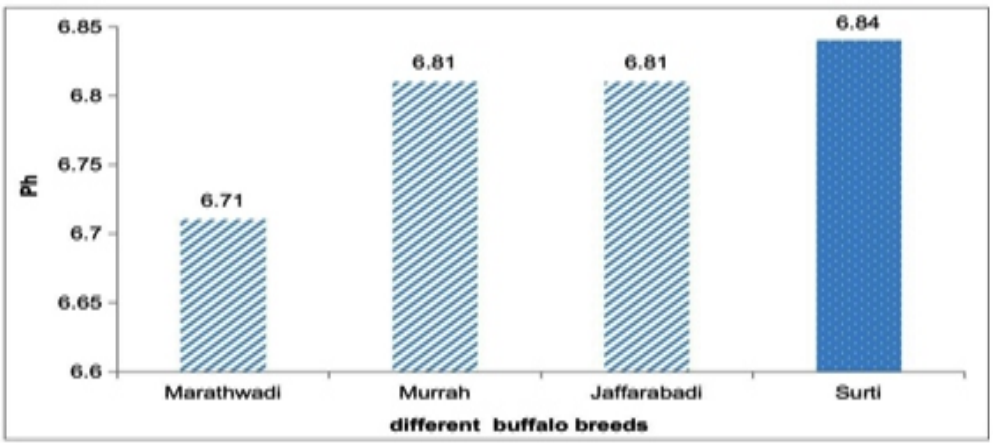


Fig. - 3.0 pH of milk of different buffalo breeds

Electrical conductivity

The higher average Electrical conductivity observed in milk of Jaffarabadi buffalo (3.82) followed bySurti, (3.78) and Murrah (3.75) and lower in Murathwadi (3.56). The differences observed in the Electrical conductivity of milk of these four breeds were non-significant. It indicated that the Electrical conductivity of these four breeds was nearly close to each other.

Table - 4.0 : Electrical conductivity of milk of different buffalo breeds

Replication		Marathwadi	Murrah	Jaffarabadi	Surti	Mean
R1		3.59	3.72	3.87	3.77	3.74
R2		3.59	3.75	3.75	3.77	3.72
R3		3.46	3.77	3.54	3.75	3.63
R4		3.23	3.71	3.81	3.73	3.62
R5		3.54	3.76	3.89	3.79	3.74
R6		3.50	3.73	3.86	3.75	3.71
R7		3.60	3.74	3.85	3.74	3.73
R8		3.50	3.81	3.82	3.85	3.74
R9		3.78	3.76	3.87	3.89	3.83
R10		3.85	3.75	3.89	3.78	3.82
Range	Max	**3.85**	**3.81**	**3.89**	**3.89**	**3.83**
	Min	**3.23**	**3.71**	**3.54**	**3.73**	**3.62**
	Mean	**3.56**	**3.75**	**3.82**	**3.78**	**3.73**
		Result	S.Ed. (±)	C.D.at5%		
Replication		NS	0.041	0.085		
buffalo		S	0.066	0.135		

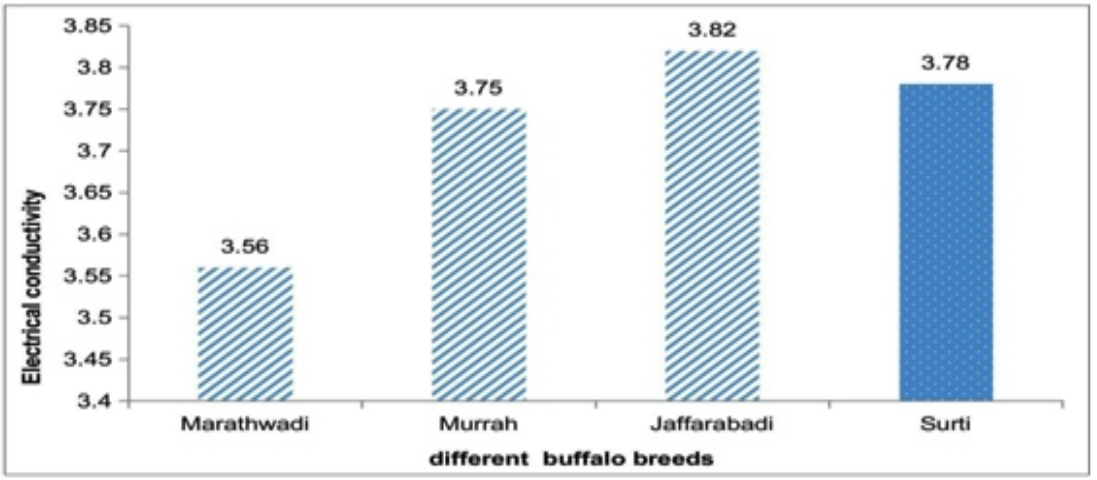


Fig. - 4.0 : Electrical conductivity of milk of different buffalo milk

Viscosity

The higher average Viscosity observed in milk of Surti buffalo (2.42) followed by Murathwadi, (2.37) and Jaffarabadi (2.31) and lower in Murrah (2.25). The differences observed in the Viscosity of milk of these four breeds were non-significant. It indicated that the Viscosity of these four breeds was nearly close to eac hother.

Table - 5.0 : Viscosity of milk of different buffalo breeds

Replication		Marathwadi	Murrah	Jaffarabadi	Surti	Mean
R1		2.37	2.08	2.24	2.30	2.25
R2		2.22	2.25	2.32	2.46	2.31
R3		2.23	2.24	2.29	2.43	2.30
R4		2.34	2.31	2.30	2.38	2.33
R5		2.41	2.29	2.33	2.32	2.34
R6		2.48	2.19	2.29	2.48	2.36
R7		2.35	2.30	2.30	2.36	2.33
R8		2.47	2.32	2.39	2.45	2.41
R9		2.43	2.28	2.30	2.48	2.37
R10		2.37	2.23	2.33	2.51	2.36
Range	Max	**2.48**	**2.32**	**2.39**	**2.51**	**2.41**
	Min	**2.22**	**2.08**	**2.24**	**2.30**	**2.25**
	Mean	**2.37**	**2.25**	**2.31**	**2.42**	**2.33**
		Result	S. Ed. (±)	C.D.at5%		
Replication		NS	0.028	0.058		
buffalo		S	0.045	0.092		

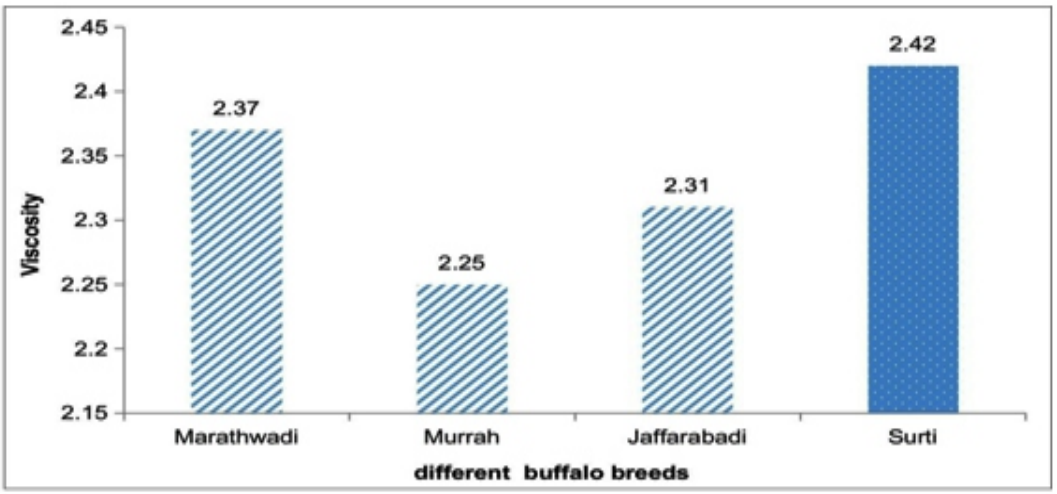


Fig. - 5.0 : Viscosity of milk of different buffalo milk

Refractive index

The higher average Refrative index observed in milk of Murrah buffalo(1.38) followed by Murathwadi, (1.37) and Jaffarabadi (1.37) and lower inSurti (1.37). The differences observed in the Refrative index of milk of thesefour breeds were non-significant. It indicated thattheRefrative index of these four breeds was near lyclose to each other.

Table - 6.0 : Refrative index of milk of different buffalo breeds

Replication		Marathwadi	Murrah	Jaffarabadi	Surti	Mean
R1		1.37	1.38	1.38	1.37	1.37
R2		1.38	1.38	1.37	1.38	1.38
R3		1.37	1.38	1.37	1.36	1.37
R4		1.37	1.38	1.37	1.37	1.37
R5		1.38	1.38	1.37	1.38	1.38
R6		1.37	1.37	1.37	1.38	1.37
R7		1.37	1.38	1.37	1.37	1.37
R8		1.37	1.38	1.38	1.37	1.37
R9		1.37	1.38	1.37	1.36	1.37
R10		1.38	1.38	1.37	1.37	1.37
Range	Max	**1.38**	**1.38**	**1.38**	**1.38**	**1.38**
	Min	**1.37**	**1.37**	**1.37**	**1.36**	**1.37**
	Mean	**1.37**	**1.38**	**1.37**	**1.37**	**1.37**
		Result	S. Ed. (±)	C.D.at 5%		
Replication		NS	0.002	0.004		
buffalo		NS	0.003	0.007		

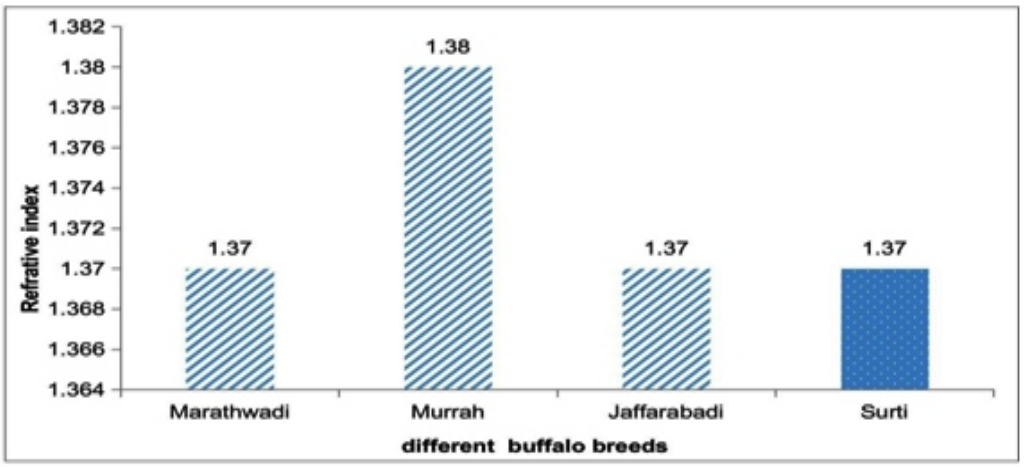


Fig. - 6.0 : Refrative index of milk of different buffalo milk

CONCLUSION

It is concluded that the physical properties of Marathwadi, Murrah, Jaffarabadi and Surti buffalo milk not differ significantly under the condition of Bundelkhand region in respect of it's breed averages.

REFERENCES

1. Basu, S.B., (1985); In Genetic Improvement of Buffaloses. I Edition, Kalyani Publishers, New Delhi, India.
2. Dubey, P.C. *et al.,* (1998). Indian Vet J., 75(3) :234-235. Furtado, M.M., (1980). Composition of buffalo milk in the Mata, Mineira Zone. Revista du Instituto de Laticinions Candido Tostes, 35(211):43-47.
3. FAO., (2008). Milk Hygiene, In Milking,

Milk Production Hygiene and Udder Health,FAO Animal Production and Health Papers-78, FAO Corporate Document Repository –7 pp.

4. Krishnamoorthy, U., H.K. Balasubramanya, S. Mallikarjunappa and A.V. Rai., (1979); Infl uence of season of birth and birth weight on subsequent body weights in Surthi calves. Indian Journal of Dairy Science, 32(1): 20- 28.

5. Misra AK, Tyagi S., (2007); In vivo embryo production in buffalo: present and perspectives. Ital J Anim Sci6 (Suppl. 2): 74-91.

6. Pawar HN., (2012); Kumar GR, Narang R. Effect of year, season and parity on milk production traits in Murrah buffaloes. Journal of Buffalo Science. 1(1):122-125.

7. Rosegrant, M. W., *et al*. (2009) Looking into the future for agriculture and AKST (Agricultural Knowledge Science and Technology). In Agriculture at a crossroads (eds B. D. McIntyre, H. R. Herren, J. Wakhungu & R. T. Watson), pp. 307 –376. Washington, DC: Island Press.

8. Ruusunen, M.,M. Salonen, H. Pulkkinen, M. Huuskonen, S. Hellstrom, J. Revez, M.L. Hanninen, M. Fredriksson-Ahomaa, and M. Lindstrom, (2013). Pathogenic bacteria in Finnish bulk tank milk. Foodborne Pathog. Dis. 10:99- 106.

9. Thornton, P. K., *et al.* (2006) Mapping climate vulnerability and poverty in Africa. Nairobi, Kenya: ILRI.

Journal of Natural Resource and Development 17 (2) 70-74, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

STUDIES ON THE EFFECT OF N:P:K AND MICRO NUTRIENTS ON YIELD OF ONION (ALLIUM CEPA L.) VARIETY- ARKA KALYAN

Mohd Arbaz, Viswanath, Rajendra Prashad, Surya Narayan, Manoj Kumar Singh and Dharmendra Kumar Singh

Department of Horticulture

Kulbhaskar Ashram Post Graduate College, Prayagraj - 211002, (U.P.). India

E-mail : mohdarbaz661@gmail.com

Received : 31.07.2022 Accepted : 22.08.2022

ABSTRACT

The present field experiment entitled "Studies on the effect of N:P:K and Micro nutrients Yield of onion (Allium cepa L.) Variety- Arka Kalyan" was carried out during Rabi season of the year 2021-2022 at Kulnhaskar Ashram Post Graduate College Prayagraj U.P.The result and conclusion of the about experiment are briefly explain here. The experiment was laid out in a randomized block design with the three replicated 11 treatments viz., T0- N:P:K (150:80:60 kg/ha) control, T1-Zn (20 kg/ha), T2- Cu (5kg/ha), T3- Boron (10kg/ha), T4- N:P:K+Zn (150:80:60+20 kg/ha), T5- N:P:K+Cu (150:80:60+5 kg/ha), T6- N:P:K+Boran (150:80:60+10) ,T7- N:P:K+Zn+Cu (150:80:60+20+5kg/ha) ,T8- N:P:K+Zn+B (150:80:60+20+10kg/ha),T9- N:P:K+Cu+B(150:80:60+5+10)andT10-N:P:K+Zn+Cu+B (150:80:60+20+5+10). The data were recorded on days 40,80,120 and harvest stage for Diameter of bulb (cm) ,Yield per plot (kg) and Yield q/ha.The data recorded highest Diameter of bulb under treatments T8- N:P:K+Zn+B (150:80:60+20+10kg/ha), at different successive stages at (40,80,120 DAT and at harvesting). The data recorded lowest Diameter of bulb treatments T1-Zn (20 kg/ha) and the data recorded highest yield per plot (kg) and yield (q/ha) under treatments T8- N:P:K+Zn+B (150:80:60+20+10kg/ha) and data were recorded lowest yield per plot (kg) and yield (q/ha) under treatments T1-Zn (20 kg/ha) at Harvesting stage.

Keywords : *Onion, micronutrients, yield*

INTRODUCTION

Onion (*Allium cepa* L.) is the most important vegetable crop of the family Alliaceae having haploid chromosome number x=8 (2n=16). The genus *Allium* having about 300 species. The type of inflorescence of onion is umbel. It is a tunicated bulb which develops in the soil. It has shallow, poor, laterally spread and scarce root system (Greenwood *et al.* 1982). It is grown as spice and vegetable crop and is used for culinary purpose.

Onion is one of the major vegetable crops grown world wide. It is essential ingredient of

various dishes in Indian diet and also called as "queen of kitchen". Apart from its use in fresh form, onions are frozen or dehydrated. Dehydrated onion is in great demand as this reduces transport cost and storage losses. Onion is rich source of calories, vitamins and minerals, especially iron, phosphorous and calcium on an average. 100 g edible part of onion bulb contain 86.6 % moisture, 11.1 g carbohydrates, 1.2 g protein, 0.1 g fat, 47 mg calcium, 11 mg vitamin C and 0.07 mg iron (Dhaliwal 2008).

The pungency in onion is due to the presence of volatile oil 'allyl propyl disulphide' (C6H12S2). The red colour of onion bulb is due to the presence of 'Anthocyanin' and yellow colour of onion due to the 'quercetin'. Studies showed that eating moderate amounts (<200 g of onion/week) results in less tendency to form blood clots and lower levels of cholesterol and lipoproteins associated with heart diseases in their blood serum than in abstainers (Brinjh *et al.* 2014)..

Onion is a heavy feeder of mineral elements. It is a shallow rooted crop which is responds well to fertilizers. A crop of 35 t/ha removes approximately 120 kg of N, 50 kg of P2O5 and 160 kg of K2O per hectare (Tandon *et al.* 1987). Heavy application of inorganic fertilizers degrades the soil health by adversely affecting the microbial biodiversity, physical and chemical environment of soil (Anjanappa *et al*., 2012)..

The functional role of Zn include auxin metabolism, influence on the activity of dehydrogenase, carbonic anhydrase enzymes, synthesis of cytochrome and stabilization of ribosomal fractions. Zinc also plays an important role in chlorophyll formation. Zinc plays an important role in chlorophyll formation. Application of Zinc increased the yield of onion (Phor et al. 1995)[16] . Boron is a very sensitive element and plants differ widely in their requirements but the ranges of deficiency and toxicity are narrow. It is necessary for normal cell division, nitrogen metabolism and protein formation. It is essential for proper cell wall formation. Application of boron can increase bulb size and yield of onion (Smriti et al. 2002)

MATERIALS AND METHODS

A field experiment was conducted during Rabi 2021 to study the "Studies on the effect of N:P:K and micro nutrients on yield of onion (*Allium cepa* L.) var. Arka kalyan". The details of material and methods used and the experimental technique adopted during the course of investigation are described below. The experiment was laid out at the "college farm" K.A.P.G. College Prayagraj, Uttar Pradesh. This region falls under IV Agro climatic zone of Uttar Pradesh state. The experiment was laid out in a randomized block design with three replicated 11 treatments viz., T_0- N:P:K (150:80:60 kg/ha) control, T_1-Zn (20 kg/ha), T_2- Cu (5kg/ha), T_3- Boron (10kg/ha), T_4- N:P:K+Zn (150:80:60+20 kg/ha), T_5- N:P:K+Cu (150:80:60+5 kg/ha), T_6- N:P:K+Boran (150:80:60+10) ,T_7- N:P:K+Zn+Cu (150:80:60+20+5kg/ha) T_8- N:P:K+Zn+B(150:80:60+20+10kg/ha) ,T_9- N:P:K+Cu+B(150:80:60+5+10)andT_{10}- N:P:K+Zn+Cu+B (150:80:60+20+5+10).

Yield attributes

Equatorial diameter was measured with the help of Vernier callipers at maximum width of the bulbs 5.35.

Polar diameter was measured from the neck surface to the bottom root surface of the bulb with the help of Vernier calipers.

Number of scales per bulb was counted after cutting of the bulb horizontally in two halves.

The bulb were harvested from the net plot from each treatment and total bulb weight was recorded. The bulb weight was expressed as bulb yield per plot in kilogram.

Bulb yield in quintal per hectare was calculated on the basis of the total yield obtain per plot.

RESULTS AND DISCUSSION

1. Size of bulb

Data recorded was analyzed for different treatments . The effect of combination of treatments after different period of time and their interaction with size of bulb have been discussed in table-1 and presented graphically in figure-1.

The effect of different combination of N:P:K and micro nutrients treatments revealed significance variation among treatments. It is obvious from the table-9 and figure-9 that the various combination of N:P:K and micro nutrients treatments influence the size of bulb of onion.

At 40 DAT the treatment T_8 recorded maximum size of bulb (2.08cm) followed by T_7 (2.00cm) and T_4 (1.99cm) which are found at par. The minimum size of bulb (1.70 cm) was recorded under treatment T_1. Similarly T_8 also noted maximum size of bulb (2.95cm) at 80 DAT followed by T_7 (2.85cm) and T_4 (2.75cm) being at par.The minimum size of bulb at 80 DAT was minimum in T_1(2.35cm).

The table envisage that T_8 recorded first in size of bulb (4.65 cm) at 120 DAT while T_7 (4.55cm) followed by T_4 (4.40 cm) respectively and significantly at par. The T_1 recorded minimum size of bulb (3.90cm) at same days after transplanting.

At harvesting stage the treatment T_8 recorded (5.35 cm) size of bulb followed by T_7 (5.15cm) and T_4 (5.05cm) which are found at par.The minimum size of bulb recorded T_1 (4.10cm) at harvesting stage.

The size of bulb at all successive stage (40,80,120 DAT and at Harvesting stage) was recorded maximum(2.08cm,2.95 cm, 4.65 and 5.35cm) respectively under treatment T_8. Thus T_8 showed superiority over other treatments at all successive stages.

Table-1 Effect of N:P:K and micro nutrient treatments on diameter of bulb (cm.) of onion

Treat ments	Size of bulb at different successive stages			At harvest
	40 DAT	80 DAT	120 DAT	MEAN
T_0	1.95	2.50	4.00	4.25
T_1	1.70	2.35	3.90	4.10
T_2	1.96	2.65	4.15	4.40
T_3	1.42	2.70	4.20	4.50
T_4	1.99	2.75	4.40	5.05
T_5	1.80	2.60	4.30	4.60
T_6	1.90	2.55	4.25	4.70
T_7	2.00	2.85	4.55	5.15
T_8	2.08	2.95	4.65	5.35
T_9	1.90	2.80	4.35	4.80
T_{10}	1.98	2.60	4.30	5.00
C.D.				0.232
SE(m)				0.080
SE(d)				0.113
C.V.				4.727

2. Yield per plot (kg) and yield quintal per hectare

Data recorded was analyzed for different treatments. The effect of combination of treatments after different period of time and their interaction with yield per plot in kg and per hacteare in quintal of onion have been discussed in table-2 and presented graphically in figure-2.

The effect of different combination of N:P:K and micro nutrients treatments revealed significance variation among treatments. It is obvious from the table-10 and figure-10 that the various combination of N:P:K and micro nutrients treatments influence the yield per plot (kg) and yield q/ha of onion

At harvesting stage the treatment T_8 recorded maximum yield per plot (kg) and yield (q/ha) (7.80 kg and 346.66 q/ha) followed by T_7 (6.21kg and 276 q/ha and T_{10} (5.97 kg and 265.33 q/ha) which are found at par.The minimum yield

(3.98 kg and 176.88q/ha) was recorded under treatment T_1.

The yield of onion at harvesting stage maximum (7.80 kg per plot and 346.66 q/ha) respectively under treatment T_8. Thus T_8 showed superiority over other treatments at all successive stages.

Table -2 : Effect of N:P:K and micro nutrients treatment on yield of onion

Treatment	Yield per plot (kg.)	Yield per hectare (q.)
T_0	4.90	217.77
T_1	3.98	176.88
T_2	4.46	198.22
T_3	4.82	214.22
T_4	5.80	257.77
T_5	5.06	224.88
T_6	5.58	248.00
T_7	6.21	276.00
T_8	7.80	346.66
T_9	5.01	222.66
T_{10}	5.97	265.33
SE(m)	0.228125	9.0971
C.D at 5%	0.684375	27.2913

1. Size of bulb

The data pertaining to size of bulb at 40,80,120 DAT and harvesting stage as influenced by the N:P:K and micro nutrients management is presented Table-9.0 and Fig-9.0.

AT 40 DAT

Significant differences in size of bulb were observed due to N:P:K source of nutrients at 40 DAT. Among all the treatment, T_8 recorded significantly the maximum size of bulb (2.08 cm),whereas T_1 recorded significantly the minimum size (1.70cm).

AT 80 DAT

Significant differences in size of bulb were observed due to source of nutrients at 80 DAT. Among all the treatments. T_8 recorded significantly the maximum size of bulb (2.95cm) whereas T_1 recorded significantly the minimum size (2.35cm).

AT 120 DAT

Significant differences in size of bulb were observed due to N:P:K source of nutrients at 120 DAT. Among all the treatments T_8 recorded significantly the maximum size of bulb (4.65cm) whereas T_9 recorded significantly the lowest value (3.90cm).

AT HARVESTING STAGE

Significant differences in size of bulb were observed due to N:P:K source of nutrients at harvesting stage. Among all the T_8 recorded significantly the size of bulb (5.35cm), whereas T_1 recorded significantly the minimum size of bulb(4.10cm).

2. Yield per plot (kg.) and yield quintal per hectare

The data pertaining to yield of bulb at harvesting stage as influenced by the N:P:K and micro nutrients management is presented Table-10 and Fig-10.

AT HARVESTING STAGE

Significant differences in size of bulb were observed due to N:P:K soures of nutrients at harvesting stage. Among all the treatments T_8 recorded significantly the maximum yield per plot and q/ha (7.80 kg and 346.66 q/ha) whereas T_1 recorded significantly the minimum yield (3.98kg and 176.88q/ha).

CONC

A field investigation entitled “Studies on the effect of N:P:K and micro nutrients on growth and yield of onion (Allium cepa L.) Vareity- Arka Kalyan” was carried out in 2021-22. The experiment was laidout in the experimental field of

Department of Horticulture Kulbhaskar Ashram Post Graduate College Prayagraj (UP) India.There were 11 treatments consisted of N:P:K (150,80.60 kg),Boron (10kg) Zinc (20kg) and Copper (5kg).All 11 treatments were tested in a Randomized Block Design with three replications. Observation were recorded on different attributing characters of yield. The size of bulb and yield of onion at different stages of growth. The bulb production attributes were studied harvest.The final yield was work out in q/ha on the basis of produce obtained in the net plot area.

1. The development of bulb measured in terms of diameter gave significant response to N:P:K and micro nutrients at late stage of growth (120 DAT and Harvest stage).
2. The yield of onion was significantly enhanced with the application of N:P:K and micro nutrients (T_8-7.08 kg/ha and 346.66q/ha).

The result of field investigation (2021-2022) reveal that onion response wells to N:P:K B, Zn and Cu fertilization. The yield of onion maximized with the application 150:80:60 kg N:P:K and 20,5 and 10 kg Zn, Cu and B.

This conclusion result was obtained when half quantity of nitrogen and entire quantity of P_2O_5, K_2O, Zn,Boron and Cu were given as a basal dose and the remaining amount of nitrogen was applied in two equal doses after transplanting as top dressing.

REFERENCES

1. Alam MN, Abedin MJ and Azad MAK. 2010. Effect of micronutrients on growth and yield of onion under calcareous soil environment. Journal of Agriculture Science, 1(3): 56-61
2. Acharya U, Venkatesan K, Saraswathi T and Subramanian KS. 2015. Effect of zinc and boron application on growth and yield parameters of multiplier onion (Allium cepa L. varaggregatum Don.) var. CO-5. International Journal of Research (IJR), 2(1): 757-765
3. Baloch, M.A.; Baloch, A.F.; Gohram, B.; Ansari, A.M.N. and Quayum, S.M. 1991. Growth and yield response of onion to different nitrogen and potassium fertilizer combination levels. *Sarhad J. Agric*. 7 (2): 63-66.
4. Deho, N.A.; Wagon, M.R.; M.R.; Bloach, M.K.; Rajpar, I.; Keerio, M.I. 2002. NPK trial on onion (*Allium cepa* L.) *Pakistan J. of Applied Sciences* 2 (8): 820-821.
5. . *Sci.* 5(2): 151-160.
6. Jawadagi, R.S., Basawaraj, N., Patil, B.N., Naik, B.H. and Channappagoudar, B.B. 2012. Effect of different sources of nutrients on growth, yield and quality of onion (*Allium cepa* L.) cv. Bellary Red. *Karnataka J. Agric. Sci.,* 25(2): 230-235
7. Khan AA, Zubair M, Bari A and Maula F. 2007. Response of onion (Allium cepa) growth and yield to different levels of nitrogen and zinc in swat valley. Sarhad Journal of Agriculture, 23(4).
8. Krik by and Romheld. Response of onion (Allium cepa) growth and yield to different levels of nitrogen and zinc in swat valley. Sarhad Journal of Agriculture, 23(4).
9. Singh DP and Tiwari RS. 1995. Effect of micronutrients on growth and yield of onion (Allium cepaL.) variety Pusa Red. Recent-Horticulture, 2(2): 70-77.
10. Thakare RG, Jadhao BJ, Nandre DR, Ghawade SM and Khewale P. 2007: Effect of zinc and iron levels on growth and yield of potato. Indian Journal of Plant Archives. 7(1) 275-276.

Journal of Natural Resource and Development 17 (2) 75-82, 2022 | NAAS RATING : 3.77 | ISSN-0974-5033

DIVERSITY AND DISTRIBUTION OF SOME HEMIPTERA FAUNA IN THE DIFFERENT FOREST AREAS OF NORTH-WEST HIMALAYA

Sanjay D. Paunikar[1*], Sandeep Kushwaha[1], Pradeep Chandra Saha[2] and Sonam Jahan[3]

Zoological Survey of India, Northern Regional Centre[1*], Dehradun, (Uttarakhand), India

Zoological Survey of India, Central Zone Regional Centre[1*], Jabalpur - 482002, (Madhya Pradesh), India

Zoological Survey of India[3], M- Block, New Alipore, Kolkata - 700053, India

Government Science College[2], Jabalpur - 482002, (Madhya Pradesh), India

E-mail : sanjaydpaunikar2020@gmail.com

Received : 11.08.2022

ABSTRACT

The present paper pertains to 27 species of 23 genera under 7 families, belonging to suborder Heteroptera under order Hemiptera occurring in different forest areas of North-West Himalaya, viz., Himachal Pradesh and Uttarakhand. The family Pentatomediae is found to be as dominant family, incorporated a total of 9 species of 8 genera and followed by family Rhophalidae and Rhyparocromidae represents 4 species whereas Miridae, Coreidae, Alydidae, Largidae and Pyrrhocoridae having 2 species each. The distribution of hemiptera fauna in different forest areas of North-West Himalaya has been discussed.

Accepted : 20.09.2022

Keywords : *Hemiptera, diversity, forest insect, North-West Himalaya*

INTRODCUTION

Insects are most important animals and play significant role in the various ecosystems (Lefroy 1909). They play very crucial role as a pollinators, decomposers, preys and predators in the different ecosystem. The insect distribution is mainly influenced by the ecological, climatic and edaphic factors, such as the vegetation, rainfall and temperature. Habitat structure influences insect diversity and abundance (Spitzer *et al*., 2008). The occurrence and abundance of insects may directly reflect environmental changes (Wahizatul *et al*., 2011). Several orders of insects are pests of forestry, agricultural, vegetable and commercial crops causing enormous crop losses both in terms of quality and quantity yield production (Beeson, 1941, Browne, 1968, Nair, 2007, Dhaliwal *et al*., 2010). They are also dangerous for the forest health (Sambhuraju *et al*., 2016). The pest problem in forest and agriculture has gained importance because many are resistant due to indiscriminate use of different chemical insecticides which kill the

natural enemies of insect pests. Contrary to the harmful insects, there are beneficial insects too, which act as biocontrol agents (Ghosh, 2008; Kulkarni, 2014). Among the pests and predators several insect orders, Hemiptera is one of the most important insect for forest and agricultural ecosystem as predators of other harmful insect pests.

Hemiptera is the fifth largest group of insects, most of them are phytophagous and feed on roots, leaves, stem, fruits and seeds, and few of them are blood suckers (Triatominae: Reduviidae). Indian Hemiptera includes several species of forestry agricultural and commercial pests (Beeson, 1941; Butani, 1979; Chandra *et al*., 2012), which are important from the viewpoint of economic damage and loss to various crops (Dhaliwal *et al*., 2010). These insects act as menace to agriculture because of the remarkable ability of some hemipteran insects to transmit viral diseases of many plants in our country. Most of the species are responsible for direct or indirect injury to various plants. Some are extremely destructive, e.g. Cicadellidae-Leafhoppers, the Aleyrodidae-whiteflies, the Aphididae-plant lice and the Coccidae- scale insects (David and Kumaraswamy, 1975; Varshney *et al*., 2002; Ghosh, 2008; Sundararaj *et al*., 2021). The extensive damage caused by these insects is due to sucking of plant sap and very fast rate of reproduction in case of many Homoptera (Atwal, and Dhaliwal 1999). Some of the homopterans (Coccids) are, however, useful to mankind because these insects are either a source of stick lac of commerce in India or of dye stuff like cochlnal and kermis. The families Reduviidae occurs throughout the world and are voracious predators. Hence they are referred to as "Assassin bugs". These bugs may not be useful as predators of specific pests being polyphagous, but they are valuable predator for controlling the populations of a variety of insect pests (Nair, 2007). Some heteropterans are predaceous and thus keep check on the populations of other insect pests. Some the Hemipteran insects are extensively used for the biocontrol agents against number of the other insect pests of forestry agricultural and vegetable crops. These insects are of great economic importance (Ghosh, 1998).

Recently, 1,841 species belonging to 70 families are known from the Indian Himalaya including Jammu and Kashmir, Uttarakhand and Himachal Pradesh. In the North-West Himalaya 607 species have been reported by Chandra *et al*., 2018. After review of literature, it was found that the only fragmentary study has been investigated on the hemipteran diversity and their pests status in the North-West Himalaya.

However, no investigations have been undertaken to record the number of hemiptera fauna present in different forest areas of North-West Himalaya. With this background of information a study on diversity of hemiptera, species composition and their pests and predator status was undertaken in the two North-West Himalayan states, Himachal Pradesh and Uttarakhand, with the intension of providing a base line data for future research work in the field of Hemiptera diversity.

MATERIALS AND METHODS

A survey was conducted to investigate the forest insect diversity including Hemiptera different forest areas of North-Western Himalayan states, Himachal Pradesh and Uttarakhand during 2018-2019. The insects were collected by hand picking, net trap and light tarp methods in different types of forest such as deodar, chir pine, mixed and sal and teak forest of two states. The details of survey and sampling localities, districts, states, forest types vegetation, GPS coordinates and altitude given in Table.1. The specimens were shorted out and bugs were pinned and dried and identified with the help of literature available.

Table - 1 : Details of Surveyed localities of North-West Himalayan States

Sr. No.	Forest areas	District/ States	Forest types	GPS coordinates	Altitude, m
1	Dharmashala Forest area	Kangra Himachal Pradesh	Deodar and Chir pine forest	N 32° 14. 993' E 076° 17. 984'	2000
2	Khajjar, Kalatop, Khajjiar WLS	Himachal Pradesh	Deodar and Chir pine forest	N $32^0$32.772' 076^0 03.550'E	1457
3	Dalhousie Forest area	Chamba/ Himachal Pradesh	Deodar and Chir pine forest	N 32°33.772′ E 076°03.550′	1970
4	Rajpura Forest area	Chamba/ Himachal Pradesh	Mixed forest, Bushes, Flowering plants	N 32°59.630′ E 076°10.60′	489
5	Govind Wildlife Sanctuary	Uttarakashi Uttarakashi, Uttarakhand	Chir-Pine, Mixed forest, Bushes, Flowering plants	N $31^0$04'13.05' E $078^0$06'16.01'	1438
6	Taluka forest area,	Uttarakashi, Uttarakhand	Chir-Pine, Mixed Forest, Bushes, Flowering plants	N $31^0$04'43.89' E $078^0$14'45.04'	2100

RESULTS AND DISCUSSION

The present study described the 27 species of 23 genera of 8 families, belonging to suborder Heteroptera under order Hemiptera occurring in different forest areas of North-West Himalaya, *viz*., Himachal Pradesh and Uttarakhand. The family Miridae with 2 species, Pentatomidae with 9 species, Coreidae with 2 species, Alydidae wit 2 species, Rhophalidae with 4 species, Rhyparocromidae with 4 species, Largidae with 2 and Pyrrhocoridae with 2 species respectively were recorded from the study area presented in Table 2. Most of the recorded species of the order Hemiptera was pests of several forestry and agricultural crops in the country, among them 17 species were pest and 10 species reported as predators. The family Pentatomidae is dominating family with 9 species, followed by Rhophalidae and Rhyparocromidae with 4 species each and remaining family with 2 species each, Fig. 1.

The member of family Pentatomidae, commonly known as stink bugs, are the most diverse family of pentatomomorphan bugs, found in all major zoogeographic regions of the world. Several species of this family found in the North-West Himalaya. In the present paper 9 species are collected and identified from the different forest areas of Himachal Pradesh and Uttarakhand.

The family Rhopalidae or scentless plant bugs, are a family of true bugs. They are often found feeding on seeds or weedy vegetation. They are similar to squash bugs, but usually smaller in size and lighter in color. Few species of these bugs are pests of ornamental plants.

The members of the family Rhyparochromidae are widely distributed throughout the world including in the Oriental region. This is the largest family of the true bugsand commonly called as seed bugs. They are small and generally brown or mottled. The fore femora are often enlarged.

There are some reports available on the different species Hemiptera fauna in the North-West Himalaya. Ghauri (1971) described a new genus of *Euscelinae* and a new species of *Balclutha* Kirkaldy (Cicadellidae) from lower Himalaya. Chakraborty *et al*. (1971, 1972a, 1972b) described a new genus, four new species of family Aphididae from Northwest Himalaya. David and Hameed (1975) described a new species and two new records of Lahaal of N.W. Himalaya. Chakrabarti and Maity (1978, 1980) described a new genus, three new species of family Aphididae from North-West India. Biswas and Animesh (2010) recorded several species of Pentatomoidea from Uttarakhand. Saba

and Hal (2010ab) recorded water-bugs belonging to 11 families of the Order - Hemiptera *viz.* Corixidae, Naucoridae, Nepidae, Belostomatidae, Notonectidae, Helotrephidae, Pleidae, ,Oerridae, Veliidae, Hydrometridae, Mesoveliidae, Lygaeidae and Pyrrhocoridae from Uttarakhand. Das *et al.* (2010) studied on the Hemiptera: Aphididae of Uttarakhand. Ghosh, and Bal, (2010ab) studied on the Cicadelloidea and Cicadoidea of Uttarakhand.

Recently, Chandra *et al*. (2018) have complied the Hemiptera fauna from Indian Himalaya including North-West Himalaya and reported 607 species. Several species of the order Hemiptera under different families are harmful insect pests of forestry, agricultural, horticultural, vegetable and commercial crops in India and some species under different families is beneficial predator on the different insect pests (Beeson, 1941, Mathur and Singh, 1954-61; Browne, 1968, Thakur, 2000; Nair, 2007; Ghosh, 2008 Chandra *et al*., 2012).

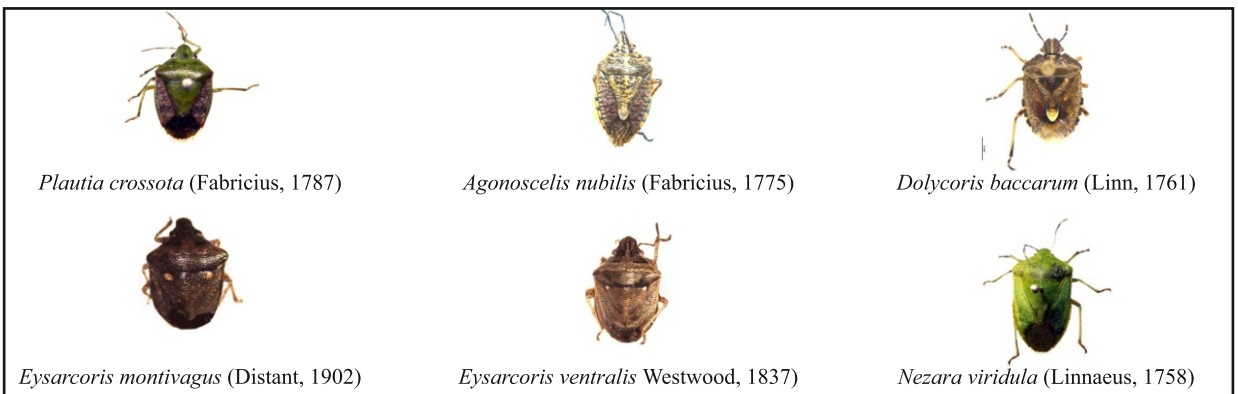
Hemiptera is one of the largest insect orders playing an important role in both natural and anthropogenic ecosystems. Numerous phytophagous hemipterans cause serious damage to agriculture and forestry, whereas some predatory species are widely used as biocontrol agents. Therefore, investigations conducted on Hemiptera are of interest for both fundamental and applied entomology.

Table - 2 : Checklist of Hemiptera recorded in different forest areas of North-West Himalaya

Sr. No	Subfamilies / Tribes	Suborder: Heteroptera Infraorder : Pentatomorpha	Status as pest or predators in forest ecosystem	Distribution in different forest areas of North-West Himalaya
I	**Superfamily: Miroidea 1. Family: Miridae**			
1	Subfamily: Mirinae Tribe-Mirini	*Charagochilus longicornis* (Reuter,1885)	Predator	Corbett Tiger Reserve, Nainital, Uttarakhand
2	Subfamily: Orthotylinae Tribe: Orthotylini	*Cyrtorhinus lividipennis* (Reuter,1885)	Predator	Corbett Tiger Reserve, Nainital, Uttarakhand
II	**Superfamily : Pentatomoidea 2. Family: Pentatomidae**			
3	Subfamily: Pentatominae Tribe: Antestini	*Plautia crossota* (Fabricius, 1787)	Pest	Chamba Forest areas, Chamba, Himachal Pradesh
4	Tribe Agonoscelidini	*Agonoscelis nubilis* (Fabricius, 1775)	Pest	Chamba Forest areas, Chamba, Himachal Pradesh
5	Tribe: Carpocorini	*Dolycoris baccarum* (Linneaus,1761)	Pest	Khajjiar, Kalatop – Khajjiar WLS, Chamba, Himachal Pradesh
6		*Eysarcoris montivagus* (Distant, 1902)	Pest	Corbett Tiger Reserve, Nainital, Uttarakhand
7		*Eysarcoris ventralis* (Westwood, 1837	Pest	Corbett Tiger Reserve, Nainital, Uttarakhand

Sr. No	Subfamilies / Tribes	Suborder: Heteroptera Infraorder : Pentatomorpha	Status as pest or predators in forest ecosystem	Distribution in different forest areas of North-West Himalaya
8	Tribe: Nezarini	*Acrosternum graminea* (Kirkaldy, 1787)	Pest	Taleru Chamera Dam Forest area, Chamba , Himachal Pradesh
9		*Nezara viridula* (Linnaeus, 1758)	Polyphagous and pest of some forestry and agricultural crops	Taleru Chamera Dam Forest area, Chamba , Himachal Pradesh
10	Tribe: Piezodorini	*Piezodorus hybneri* (Gmelin, 1790)	Pest	Corbett National Park, Ramnagar, Dist- Nainital Uttarakhand
11	Tribe: Strachiini	*Bagrada hilaris* (Burmeister, 1835)	Pest	Corbett National Park, Ramnagar, Dist- Nainital, Uttarakhand
III	**Superfamily: Coreoidea 3. Family: Coreidae**			
12	Subfamily : Coreinae Division: Gonoceraria	*Cletus punctiger* (Dallas, 1852)	Pest	Chamba Forest areas, Chamba, Himachal Pradesh
13		*Cletomorpha hastata* (Fabricius,1787)	Pest	Chamba Forest areas, Chamba, Himachal Pradesh
IV	**4. Family: Alydidae**			
14	Subfamily: Micrelyterinae	*Leptocorisa acuta* (Thunberg, 1783)	Pest	Corbett National Park, Ramnagar, Dist- Nainital, Uttarakhand
15	Subfamily Alydidnae	*Riptortus pedestris* (Fabricius, 1775)	Pest	Taleru Chamera Dam Forest area, Chamba , Himachal Pradesh
V	**5. Family: Rhophalidae**			
16	Subfamily: Rhophalinae	*Liorhyssus rubicundus* (Signoret, 1859)	Predator	Corbett National Park, Ramnagar, Dist- Nainital, Uttarakhand
17.		*Liorhyssus hyalinus* (Fabricius, 1794)	Predator	Corbett National Park, Ramnagar, Dist- Nainital, Uttarakhand
18	Subfamily: Serinathinae	*Leptocoris augur* (Fabricius, 1781)	Predator	Corbett National Park, Ramnagar, Dist- Nainital, Uttarakhand
19		*Leptocoris abdominalis* (Fabricius, 1803)	Predator	Chamba Forest areas, Chamba, Himachal Pradesh

Sr. No	Subfamilies / Tribes	Suborder: Heteroptera Infraorder : Pentatomorpha	Status as pest or predators in forest ecosystem	Distribution in different forest areas of North-West Himalaya
VI	**Superfamily Lygaeoidea 6. Family: Rhyparocromidae**			
20	Subfamily: Rhyparochrominae Tribe: Rhyparochrominae	*Metochus uniguttatus* (Thunberg, 1922)	Predator	Chamba Forest areas, Chamba, Himachal Pradesh
21		*Elasmolemus sordidus* (Fabricius, 1787)	Predator	Dalhousie Forest Area, Dist- Chamba, Himachal Pradesh
22		*Dieuchus leucocerus* (Walker, 1872)	Predator	Chamba Forest areas, Chamba, Himachal Pradesh
23		*Lachnesthus singalensis* (Dohrn, 1860)	Predator	Chamba Forest areas, Chamba, Himachal Pradesh
VII	**Superfamily Pyrrhocoroidea 7. Family: Largidae**			
24		*Iphita limbata* (Stal, 1870)*	Pest	Dalhousie Forest Area, Dist- Chamba, Himachal Pradesh
25		*Physopelta gutta* (Burmister, 1834)*	Pest	Taleru Chamera Dam Forest area, Chamba , Himachal Pradesh
VIII	**8. Family: Pyrrhocoridae**			
26		*Dysdercus koenigii* (Fabricius, 1775)	Pest	Dalhousie Forest Area, Dist- Chamba, Himachal Pradesh
27		*Dysdercus evanescens* (Distant, 1902)	Pest	Corbett National Park, Ramnagar, Dist- Nainital, Uttarakhand



Plautia crossota (Fabricius, 1787) | *Agonoscelis nubilis* (Fabricius, 1775) | *Dolycoris baccarum* (Linn, 1761)

Eysarcoris montivagus (Distant, 1902) | *Eysarcoris ventralis* Westwood, 1837) | *Nezara viridula* (Linnaeus, 1758)

Fig. - 1 : Plates of Hemiptera fauna recorded in different forest areas of North-West Himalaya

ACKNOWLEDGEMENTS

The authors are thankful to the Director, Zoological Survey of India, HQ., Kolkata for providing all possible facilities and support to undertake field surveys and to conduct research. Thanks to Dr. Gaurav Sharma, Scientist-E &

Officer-in Charge, Northern Regional Centre, Zoological Survey of India, Dehradun, Uttarakhand for providing necessary facilities and constant encourage, support during the course of study.

Thanks are also recorded to the PCCF (Head of Forest Force) and authorities of Forest Department, Himachal Pradesh and Uttarakhand for providing necessary permission to undertake the General Faunistic Survey work and DFO's of forest divisions/areas for various courtesies.

REFERENCES

1. Atwal, A.S. and Dhaliwal, G.S. 1999. Agricultural pests of South Asia and their Management. Kalyani Publishers, New Delhi.
2. Beeson, C.F.C 1941. *The Ecology and Control of Forest Insects of India and Neighbouring Countries.* Vasant Press, Dehradun, 1007 p.
3. Biswas, B and Bal, Animesh 2010. Insecta: Hemiptera: Pentatomoidea. Fauna of Uttarakhand: State Fauna Series 18: 229-244.
4. Browne. F.G. 1968. *Pests and Diseases of Forest Plantation Trees.* C1aredon Press, Oxford. 1330 p.
5. Butani D.K. 1979. Insects and fruits. Periodical Expert Book agency, New Delhi: 273-275.
6. Chakrabarti, S., Ghosh, A.K. and Raychaudhury, D.N. 1971a. New records of aphids (Insecta: Homoptera) from Uttar Pradesh. Sci. Cul. 37:47-48.
7. Chakrabarti, S., Ghosh, A.K. and Raychaudhury, D.N. 1972a. On some undescribed Morph and new records of aphids (Homoptera: Insecta) from Kumaon Himalaya, India. Curr. Sci. 41: 70-71.
8. Chakrabarti, S., Ghosh, A.K. and Raychaudhury, D.N.(1972b. New geneus, new species and further records of aphids (Homoptera: Insecta) from the Kumaon Hills, Northwest Himalaya, India. Orie. Insec. 6: 387-400.
9. Chakrabarti, S. and Maity, S. P. 1978. Aphids (Homoptera: Aphididae) of North West India: .New subgenus, new species and new records of root inhabiting aphids. Entomon, 3: 265-272.
10. Chakrabarti, S. and Maity, S. P. 1980. Aphids (Homoptera : Aphididat:) of north west India. II. Two new species and an undescribed morpho Annales Zoologici. 35: 93-114.
11. Chandra, K., Kushwaha, S., Sambath, S. and Biswas, B. 2012. Distribution and Diversity of Hemiptera Fauna of Veerangana Durgavati Wildlife Sanctuary, Damoh, Madhya Pradesh (India). Biological Forum – An International Journal, Forum, (:1 6):8-1724.
12. Chandra, K., Hassan, M.E., Mukherjee, P., Kushwaha, S. and Mukhopadhyay, E. 2018. Insecta: Hemiptera, 313-351: In Chandra K, Gupta, D, Gopi, KC, Tripathy B, Kumar, V. Faunal Diversity of Indian Himalaya: 1-872. (Published by the Director, Zool. Surv. India, Kolkata).
13. Das, B.C., Senguta, C.K. and Pramanik, N.K. 2010. Insecta: Hemiptera: Aphididae. In, Fauna of Uttarakhand, State Fauna Series, 18(2): 133-174. (Published by the Director, Zool. Surv. India, Kolkata).
14. David, S.K. and Hameed, S.F. (1975). One new species and two new records of Aphids (Homoptera: Aphididae) from Lahual in N.W. Himalaya. Oriental Insect. 9: 213-219.
15. David, B.V. and Kumaraswamy, T. 1975.Mangohoppers and their control. Elements of Economic Entomology popular book deportment, Madras, 127-28.
16. Dhaliwal, G.S, Jindal, V. and Dhawan A.K. 2010. Insect Pest Problems and Crop Losses: Changing Trends. Indian J. Ecol. 37(1): 1-7
17. Ghauri, M.S.K. 1971. A new genus Euscelinae from the lower Himalaya and a new species of Balclutha Kirkaldy (Homoptera: Cicadellidae).

Bulletin Entomological Research, 60: 113-118.

18. Ghosh, L. K. 2008. Handbook on Hemipteran Pests in India: 1. 453 (Published by Director, Zool. Suru. India, Kolkata).
19. Ghosh L.K. 1998. Faunal diversity of India: Hemiptera. Envis center, Zoological Survey of India, Calcutta 234-235.
20. Ghosh, M. and Bal, A. 2010a. Insecta: Hemiptera: Homoptera : Cicadelloidea. In, Fauna of Uttarakhand, State Fauna Series, 18(2): 175-193. (Published by the Director, Zool. Surv. India, Kolkata).
21. Ghosh, M. and Bal, A. 2010b. Insecta: Hemiptera: Homoptera : Cicadoidea. In, Fauna of Uttarakhand, State Fauna Series, 18 (2): 195-208. (Published by the Director, Zool. Surv. India, Kolkata).
22. Kulkarni N. 2014. Status of potential of biocontrol component for integrated management of forest insect pests in India., In Biopesticides in Sustainable Agriculture: Progress and Potential, O. Koul, G.S. Dhaliwal, S. Khokar, and R. Singh, eds.), Science Publisher, New Delhi, India, 389-419.
23. Lefroy, H.M. 1909. Indian insect life. A manual of the Insects of the Plains (Tropical India) Agricultural Research Institute, Pusa, 1-785 pp.
24. Mathur, R.N. and Singh, B. 1954-61. A list of insect pests of forest plants and the adjacent countries. Indian Forest Bulletin (N.S., (Ent.), 17(8): 1-35.
25. Nair, K. S. S. 2007. Tropical Forest Insect Pest Ecology impact and management. M.S. Dissertation, University of Cambridge Press New York.
26. Saha, P. C. and Bal, A. 2010a. Hemiptera : Pyrrhocoridae. In, Fauna of Uttarakhand, State Fauna Series, 18 (2): 245-253. (Published by the Director, Zool. Surv. India, Kolkata).
27. Saha, P. C. and Bal, A. 2010b. Insecta: Hemiptera: Lygaeidae. In, Fauna of Uttarakhand, State Fauna Series, 18(2): 219-228. (Published by the Director, Zool. Surv. India, Kolkata).
28. Sambaraju, K., DesRochers, P., Rioux, D., Boulanger, Y., Kulkarni, N., Verma, R.K., Pautasso, M., Pureswaran, D., Martel, V., Hebert, C., Cusson, M. and Delisle, J. 2016. Forest ecosystem health and biotic disturbances: perspectives on indicators and management approaches. Pp.460-502. In: Ecological Forest Management Handbook (Ed. Larocque, G.R.), CRC Press, Boca Raton, 589 p.
29. Spitzer, L., Konvicka, M., Benes, J., Tropek, R., Tuf, I.H. and Tufova, J. 2008. Does closure of traditionally managed open woodlands threaten epigeic invertebrates? Effects of coppicing and high deer densities. Biol. Conser. 141(3): 827-837.
30. Sundararaj, R., Krishnan S., Sumalatha B.V. 2021. Invasion and expansion of exotic whiteflies (Hemiptera: Aleyrodidae) in India and their economic importance. Phytoparasitica. 1-13.
31. Thakur, M.L. 2000. Forest Entomology (Ecology and Management). Sai Publication, Dehra Dun. pp. 255.
32. Varshney, R.K. Jadhav M.J. and Sharma R.M. 2002. Scale insects and mealy bugs (Insecta: Homoptera: Coccoidea), Zoological Survey of India, western regional centre. Recent Zoological Survey India, pp: 139- 152.
33. Wahizatul, A.A., Long, S.H. and Ahmad, A. 2011. Composition and distribution of aquatic insect communities in relation to water quality in two freshwater streams of Hulu Terengganu, Terengganu. J. Sustainability Science and Manag. 6(1): 148-155.