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# EFFECT OF INTEGRATED PLANT NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF BRINJAL (SOLANUM MELONGENA L.) CV. PUSA HYBRID-6

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## ABSTRACT

**A field experiment was conducted on Effect of integrated plant nutrient management on growth and yield of brinjal ( Solanum melongena L.) cv. Pusa Hybrid-6 at Instructional cum research farm, Department of Horticulture, Kulbhaskar Ashram Post Graduate College Prayagraj (Allahabad) UP. During Rabi season 2023-24. The experiment was laid out in Randomized Block Design (RBD) with 16 treatment of replicated thrice with T0[100% RDF (100N:80P:80 kg/ha)],T1 [5 tones vermicompost], T2[ 8 tones vermicompost ],T3[25 % N and RDF+ 5 tones vermicompost],T4[25 % N and RDF+ 8 tones vermicompost]T5[50 % N of RDF + 5 tones vermicomposT],T6[50 % N of RDF + 8 tones vermicompost],T7[75 % N of RDF + 5 tones vermicompost],T8[75 % N of RDF + 8 tones vermicompost],T9[75 % N of RDF + P&K],T10 [75% N of RDF + recommended dose of P&K],T11[75% N of RDF + recommended dose of P&K + 2 kg Azotobocter],T12[T3 + 2kg Azotobacter /ha],T13[T5 + 2kg Azotobacter /ha],T14[T6 + 2kg Azotobacter /ha] T15[ T7 + 2kg Azotobacter /ha]**

***Keywords :*** *INM, brinjal, growth, yield, quality, biofertilizers*

## INTRODUCTION

Brinjal or egg-plant is one of the most common, popular and principal among solanaceous vegetable crops grown in India and other parts of the world. It can be grown in almost all parts of India except higher altitudes all the year round. A number of cultivars are grown throughout the country depending upon the yield, consumer's preference about the colour, size and shape of the various cultivars. The brinjal is of much importance in the warm areas of For East, being grown extensively in India, Bangladesh, Pakistan, China and the Philippines. It is also popular in France, Italy and the United States. It is highly productive and usually finds its place as the poor man's crop. In India, it is being consumed as a cooked vegetable in various ways. The cultivated brinjal is undoubtedly of Indian origin and has been in opinion that its centre of origin was in the Indo-Burma region. According to 4 | P a g e Purewal (1957), it is still found growing wild in India. Whereas, Zeven and Zhuskovsky (1975) were of opinion that it has a secondary centre of variation in China. Brinjal has been a staple vegetable in our diet since ancient times. It is liked by both poor and rich, contrary to the common belief, it is quite high in nutritive value and can well be compared with tomato (Choudhary, 1976a). According to Aykroyd (1963) it contains 91.5% water, 6.4% Carbohydrates, 1.3% protein, 0.3% fat, 0.5% mineral matters (0.02% Ca, 0.06% P, 0.0013%Fe). Nadkarni (1927) has given the medicinal uses of brinjal as pierced all over with a needle and dried in till oil, the fruit is employed as a cure for toothace. It has a also been recommended as an excellent remedy for those suffering from liver complaints (Chauhan, 1981) and even for cancer patients. White brinjal is said to be good curative for diabetic patients (Chaudhary, 1966). The green leaves of brinjal plant are the main source of the supply of antiscorbutic vitamin C. The use of bio-fertilizers hold a great promise in the technology driven agriculture in general and in vegetable crops particular which was found encouraging. The modern day intensive crop cultivation requires the use of huge amount of chemical fertilizers which are not only costly but also in short supply. Moreover, after unscrupulous use, chemical fertilizers as like pollutant and robs the soil of its texture and structure as well as nutrient status. The current trend is, therefore to exploit the possibility of supplementing chemical fertilizers with organic ones, more particularly bio- fertilizers of microbial origin. Recently, biffertilizers have emerged as an important tool and component of integrated plant nutrient supply and had a promise to improve crop yields and nutrient supplies. In this regard bacteria (Azotobacter, Azospirillum and Phosphobacteria) as well as fungi vesicular arbusicular mycorriha (VAM) have attracted considerable attention owing to their ability to supplement N, P, and K fertilizers and improve crop productivity that ultimately reduces the input cost of chemical fertilizers. Among them Azospirilla are a group of bacteria found in loose association with the root system of many crop plants. It is a symbiont whose bacterial cells are found colonizing the root cortical cells or the intercellular spaces in the cortex. These bacteria grow better under reduced oxygen levels. They fix nitrogen from 10 to 40 Kg/ha by colonizing the root system of many vegetables plants. Azospirillum inoculation helps the plant in better vegetative growth saving 25-30% nitrogenous fertilizers. In view of facts and figure stated in preceding paragraphs an experiment on the problem entitled, "Effect of integrated plant nutrient management (IPNM) on growth and yield of brinjal (*Solanum melongena* L.) Pusa Hybrid-6".

## MATERIALS AND METHODS

The experiment was carried out at instructional cum research farm, Department of Horticulture, Kulbhaskar Asharam Post Graduate Collage Prayagraj, UP. During Rabi season 2023-24. The experiment was laid out in Randomized Block Design (RBD) with 16 treatment of replicated thrice.

| Sr.No. | Treatment | Notation |
|---|---|---|
| 1 | 100%RDF(100N:80P:80kg/ha) | T0 |
| 2 | 5tonesvermicompost | T1 |
| 3 | 8tonesvermicompost | T2 |
| 4 | 25%NandRDF+5tonesvermicompost | T3 |
| 5 | 25%NandRDF+8tonesvermicompost | $T_4$ |
| 6 | 50%NofRDF+5tonesvermicompost | T5 |
| 7 | 50%NofRDF+8tonesvermicompost | T6 |
| 8 | 75%NofRDF+ 5tonesvermicompost | T7 |
| 9 | 75%NofRDF+8tonesvermicompost | T8 |
| 10 | 75%NofRDF+P&K | T9 |
| 11 | 75%NofRDF+recommendeddoseofP&K | T10 |
| 12 | 75%NofRDF+recommendeddoseo fP&K+2kgAzotobocter | T11 |
| 13 | T3+2kgAzotobacter/ha | T12 |
| 14 | T5+2kgAzotobacter/ha | T13 |
| 15 | T6+2kgAzotobacter/ha | T14 |
| 16 | T7+2kgAzotobacter/ha | T15 |

There were altogether 48 plots each of 3.75mX3.75m 2size. The seedlings were raised in the nursery section of the college farm by sowing the treated seed with 0.2% Bastian on the raised bedsin lines on November 25, in both the seasons of cropping and the seedlings of about 5 weeks in age were transplanted on January 2, each year in well prepared field at the distance of 75cm X 60cm followed by a light irrigation. The observation was recorded i.e. Height of plant(Cm),Number of green leaves ,Diameter of stem(Cm), Number of primary branches, Length of the longest primary branches(Cm), Width of the longest primary branches(Cm), Length of the longest leaf(Cm), Width of the longest leaf(Cm)

## RESULTS AND DISCUSSION

### Growth Parameter

### Height of plant(Cm)

Further, the application of 50% rdof N along with recommended dose of P and K + 50 tonnes VERMICOMPOST per hectare + 2 kg Azasprillium perhectare (T15) maintained its supremacy in this respect over other IPNM treatments (T, to T4) through-out the growth period. The second best treatment was T12 (75% RD of N along with recommended dose of P and K + 50 tones. These results are accordance to the findings of Patil et al. (2004) [3]; Chumei et al. (2014)[3] and Manickam et al. (2021)[

### Number of green leaves

Ever, the magnitude of increase in this character was recorded comparativelymorewith Tis followed by T12, T9, T6, T9,T11, T8, T5, T13, T10, T7, T4, T2, T,and T; How in descending order. Further, these IPNM treatments T, to Tis contributed considerably more number of green leaves per plant over the control (To) throughout the period of investigation in both the seasons of cropping. These results are accordance to the findings of Patil et al. (2004) [3]; Chumei et al. (2014)[3] and Manickam et al. (2021)]

### Diameter of stem(Cm)

The second best treatment as noted was 2 in respect of this finding which was followed byT9,T6. T14. T11, T8, T5, T13, T10, T7, T4, T4.T2. T5 and T3 in the order of merit during the entire period of growth. In general, the stem thickness as recorded was influenced favorably by IPNMT, to Tis treatments over the control (To) at all the stages of observation in 2022-23 & 2023-24 experimentation.

### Number of primary branches

It is observed from that in the first periodically observation and onward during the entire period of growth in both the seasons of cropping the effect of varied IPNM treatments T, to T1s over the a control (To) on this finding was more pronounced and that too was more striking and meaningful with T1s in comparison to all other IPNM treatments. Role of NPK, organic and biofertilizer in a balanced combination is enhancing the number of branches has been well documented by Kumaran et al. (1998) [10]; Anburani and Manivannan (2002)[1] and Reddy et al. (2002)[16]. Patil et al. (2004)[13] and Manickam et al. (2021) [11] also reported the similar results.

### Length of the longest primary branches (Cm).

Furthermore, the margin longest leaf was registered relatively more with Tisover others throughout-the cropping span in both the years. The second best treatment as noted wasT2. Role of NPK, organic and biofertilizer in a balanced combination is enhancing the number of branches has been well documented by Kumaran et al. (1998) [10]; Anburani and Manivannan (2002)[1] and Reddy et al. (2002)[16]. Patil et al. (2004)[13] and Manickam et al. (2021) [11] also reported the similar results.

**Width of the longest primary branches (Cm)**

However, the magnitude of increase in this character was recorded comparatively more with T1s followed by T12,.To. T6, T14. T1, T9, T5 T13, T1o, T7, T4, T2, T1 and T3 in descending order. Further. these IPNM treatments T1 to T2 is contributed considerably more number of primary branches per plant overthe control (To) at all the stages of noting in both the seasons of cropping. Role of NPK, organic and biofertilizer in a balanced combination is enhancing the number of branches has been well documented by Kumaran et al. (1998) [10]; Anburani and Manivannan (2002)[1] and Reddy et al. (2002)[16]. Patil et al. (2004)[13] and Manickam et al. (2021) [11] also reported the similar results.

**Length of the longest leaf(Cm)**

The entire period a of growth in both the seasons of cropping the effect of varied IPNM treatments T, to Tis over the control (To) on this finding was more pronounced and that too was more striking and meaningful with Ts in comparison to others. The next best treatment was T12.

**Width of the longest leaf(Cm)**

An examination of the data summarized in Table II revealed that the maximum limits of these growth attributes in both the years were recorded with Tis which were significantly higher than that of other IPNM treatments from To to T14. The second best treatment was T14.

**PER FRUIT STUDIES**

A sample of five fruits from the produce of each net plot at mid picking was chosen randomly for recording the data on the follow in characters. Fresh weight of market able and un-marketable fruit(gm)Diameter of fruit (cm),Length of fruit (cm),Length of fruit-stalk(cm),Diameter of fruit-stalk (cm).The maximum fresh weight of marketable fruit 215.37 gm and 215.70gm; and its length 9.11 cm and 9.44 cm. diameter 7.99 Cm and 8.33 cm, Volume 276.14 cm and 276.47 cm and specific gravity 0.784 and 0.787 of fruit, as well as its length of fruit-stalk 4.77 Cm and 5 10 cm, and that of its diameter 1.50 cm and 1.53 cm was noted with T15 in 2004-05 and 2005-06,respectively which surpassed other IPNM treatments from T, to T14 where as all the IPNM treatments from T, to Tis over the control (To) proved their significant utility in respect of these per fruit traits in both the years of trial.

The size of brinial fruit in terms of it sweight, length, diameter, volume and specific gravity as well as its stalk length and diameter depends mainly upon the photosynthetic activity of plant hence the healthy plants in these studies might have produced the bigger sized fruits under T15 over others in this investigation.

Such an effect a of IPNM treatment T15 on growth parameters, yield and its attributes has also been reported by (Kalda and Gupta (1996). Furthermore, this may mainly be due to the greatest nitrogen metabolism as well as biological activities which, in turn, might held responsible for the production of larger sized fruits as auvocated by (Crowther (1935).

**CONCLUSION**

It could be concluded from the present investigation that, the integrated nutrient management significantly influenced the Effect of integrated plant nutrient management on growth and yield of brinjal ( *Solanum melongena* L.) cv. Pusa Hybrid-6. Among the different levels of integrated nutrient management optimum growth, yield and quality was obtained from $T_0$ [100% RDF (100N:80P:80kg/ha)].

**Table - 1 : Effect of integrated plant nutrient management on growth and yield of brinjal**

| Treatment | Height of plant (cm) | No of green Leaves | Diameter of stem(cm) | No of primary branches | Length of the longest primary branch | Width of the longest primry branch cm | Length of the longest leaf (cm) | Width of the longest leaf(cm) |
|---|---|---|---|---|---|---|---|---|
| **T0** | 74.33 | 99.37 | 2.72 | 1 1.18 | 79.67 | 36.62 | 13.28 | 5.04 |
| **T1** | 77.47 | 1 11.21 | 2.77 | 11.32 | 81.69 | 39.84 | 13.58 | 5.23 |
| **T2** | 78.37 | 1 19.77 | 2.79 | 1 1.62 | 82.76 | 41.35 | 13.61 | 5.38 |
| **T3** | 75.56 | 109.22 | 2.75 | 1 1.24 | 80.11 | 38.41 | 13.41 | 5.07 |
| **T4** | 79.66 | 123.04 | 2.81 | 11.73 | 84.27 | 44.14 | 13.64 | 5.42 |
| **T5** | 81.10 | 137.39 | 2.82 | 12.26 | 85.50 | 47.30 | 13.74 | 5.47 |
| **T6** | 82.54 | 148.18 | 2.85 | 12.30 | 86.14 | 50.59 | 13.76 | 5.50 |
| **T7** | 83.64 | 160.11 | 2.87 | 12.44 | 87.44 | 54.26 | 13.86 | 5.51 |
| **T8** | 84.46 | 167.67 | 2.89 | 12.61 | 88.73 | 58.55 | 14.02 | 5.58 |
| **T9** | 86.24 | 171.58 | 2.92 | 12.72 | 90.42 | 61.33 | 14.23 | 5.62 |
| **T10** | 87.06 | 177.56 | 2.95 | 12.80 | 91.40 | 65.08 | 14.31 | 5.65 |
| **T11** | 88.10 | 181.49 | 2.98 | 13.18 | 92.29 | 70.64 | 14.37 | 5.68 |
| **T12** | 90.08 | 188.47 | 3.02 | 13.27 | 93.43 | 74.19 | 15.68 | 5.72 |
| **T13** | 91.44 | 192,15 | 3.05 | 13.34 | 95.45 | 77.25 | 15.74 | 5.78 |
| **T14** | 92.15 | 194.12 | 3.09 | 13.57 | 96.32 | 80.35 | 15.83 | 5.85 |
| **T15** | 94.00 | 196.34 | 3.12 | 13.67 | 97.96 | 83.51 | 16.07 | 5.90 |
| SEA ± | 0.342 | 10.05 | 0.0031 | 0.03123240464 | 0.1565830273 | 0.48276658725 | 0.01226633115 | 0.01134884223 |
| CD at | 0.698 | 20.51 | 0.00631 | 0.06377657027 | 0.31974254174 | 0.98580937116 | 0.0250478482 | 0.02317433583 |


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**Table - 2 : Effect of integrated plant nutrient management on growth and yield of brinjal**

| Treatment | Fresh weight of marketable fruit (gm) | Fresh weight unmarketable fruit m | Length of fruit (cm) | Diameter of fruit(cm) | Fresh weight marketable fruit (gm) | Fresh weight Of un -marketable fruit (gm) | Length Of fruit(cm) | Diameter Of fruit(cm) |
|---|---|---|---|---|---|---|---|---|
| $T_0$ | 149.38 | 200.50 | 7.24 | 6.34 | 150.05 | 200.84 | 7.57 | 6.67 |
| $T_1$ | 152.42 | 191.2 | 7.38 | 6.65 | 152.76 | 191.55 | 7.71 | 6.98 |
| $T_2$ | 155.31 | 185.56 | 7.46 | 6.73 | 155.64 | 185.83 | 7.79 | 7.06 |
| $T_3$ | 151.24 | 146.47 | 7.30 | 6.54 | 151.58 | 196.81 | 7.64 | 6.87 |
| $T_4$ | 157.48 | 172,60 | 7,75 | 6.87 | 157.81 | 172.94 | 8.09 | 720 |
| $T_5$ | 160.33 | 166.14 | 7.86 | 6.97 | 160.66 | 166.47 | 8.19 | 7.30 |
| $T_6$ | 162.44 | 161.14 | 7.95 | 7.05 | 162.78 | 161.47 | 8.28 | 7.39 |
| $T_7$ | 167.24 | 156.29 | 8.02 | 7.18 | 167,58 | 156.62 | 8.35 | 7.52 |
| $T_8$ | 171.24 | | 8.08 | 7.33 | 171.58 | 152.72 | 8.42 | 7.66 |
| $T_9$ | 176.46 | 147,45 | 8.23 | 7.39 | 176.79 | 147.79 | 8.56 | 7.73 |
| $T_{10}$ | 181.55 | 14515 | 8.48 | 7.47 | 181.88 | 145.58 | 8.82 | 7.80 |
| $T_{11}$ | 187.57 | 142.36 | 8.57 | 7.53 | 187,90 | 142.69 | 8.97 | 7.86 |
| $T_{12}$ | 200.44 | 140.84 | 8.78 | 7.61 | 200.77 | 141.17 | 9.11 | 7.95 |
| $T_{13}$ | 206.55 | 137.20 | 8.90 | 7.69 | 206.83 | 137.54 | 922 | 8.03 |
| $T_{14}$ | 21 1.41 | 136.47 | 9.04 | 7.91 | 211.75 | 136.80 | 9.38 | 824 |
| $T_{15}$ | 215.37 | 134.56 | 9.11 | 7,99 | 215.70 | 134.90 | 9.44 | 833 |
| SEM ± | 0.231921 | 0.171199 | 0.185172 | 0,08046 | 0.2826725 | 0.1712769 | 0.165 | 0.0801 |
| CDat 5% | 0.473595 | 0.34968 | 0,37812 | O.163638 | 0.5772173 | 0.34974742 | 0.33301 | 0.16369 |

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# EFFECT OF HERBICIDES ON DENSITY AND BIOMASS OF BROAD LEAVED WEED IN WHEAT (TRITICUMAESTIVUM L.)

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## ABSTRACT

**Effective weed management is essential for optimizing wheat yield and quality. This study evaluates the impact of various broadleaf herbicides on weed density and biomass in wheat fields. Conducted during the Rabi seasons of 2021-2022 and 2022-2023 at Pili Kothi, Jaunpur, Uttar Pradesh, the experiment assessed Carfentrazone, Metsulfuron Methyl, and Florasulamat different application rates. Carfentrazone, particularly at higher doses, was the most effective in reducing weed density and biomass. Metsulfuron Methyl also proved effective but less so than Carfentrazone. Florasulam was less effective and resulted in higher weed densities and biomass compared to the other treatments. The weed-free control achieved zero weed density, emphasizing the importance of timely herbicide application for effective weed control in wheat cultivation.**

***Keywords:*** *Broadleaf herbicides, weed management, wheat, carfentrazone, metsulfuron methyl, florasulam, weed density, biomass*

## INTRODUCTION

Weed management is a critical aspect of sustainable agricultural practices, particularly in cereal crops such as wheat. Broadleaf weeds, in particular, pose significant challenges to wheat production by competing for resources such as light, water, and nutrients, ultimately impacting crop yield and quality. The effective control of these weeds is essential for maximizing wheat productivity and ensuring efficient resource use.

Herbicides have become a cornerstone in modern weed management due to their ability to selectively target and control unwanted plant species while minimizing damage to the crop. The impact of herbicides on broadleaf weeds, however, varies depending on the type and application rate of the herbicide used. This variation necessitates a thorough understanding of how different herbicides influence the density and biomass of broadleaf weeds in wheat fields.

The effectiveness of herbicides in controlling broadleaf weeds can be assessed by examining their impact on weed density and biomass. Density refers to the number of weed plants per unit area, while biomass measures the total mass of these plants, reflecting their growth and competitive ability. High weed density and biomass can severely detract from wheat yield by overshadowing the crop and competing for essential resources. Therefore, evaluating how different herbicides affect these parameters is crucial for optimizing weed management strategies.

## MATERIALS AND METHODS

The experiment titled " Effect of herbicides on density and biomass of broad leaved weed in wheat (*Triticumaestivum* L.)" was conducted during the Rabi (winter) seasons of 2021-2022 and 2022-2023 at the Agronomy Research Farm of Pili Kothi, Jaunpur, Uttar Pradesh, India. The site is characterized by its subtropical climate, which features cool winters and moderate rainfall, conducive to wheat cultivation. A randomized block design (RBD) with three replications was used for this experiment. This design was selected to minimize variability and ensure reliable results. Each experimental plot was randomly assigned one of the herbicide treatments or the control.

### Data Collection

1. **Weed Density**: Weed density was assessed by counting the number of broadleaf weed plants per square meter in each plot. Measurements were taken at 30,60,90 days after sowing to determine the impact of each herbicide treatment on weed populations.
2. **Weed Biomass**: To evaluate the biomass of broadleaf weeds, weeds were harvested from a sample plot, dried to a constant weight, and weighed. The biomass was recorded in grams per square meter.

### Statistical Analysis

Data was analyzed using statistical software, e.g., R, Excel. Analysis of variance (ANOVA) was performed to determine the significance of differences among the herbicide treatments. This methodology ensures a thorough examination of the effects of broadleaf herbicides on both the density and biomass of broadleaf weeds in wheat, providing insights into effective weed management strategies.

## RESULTS AND DISCUSSION

### Effect of herbicides on density and biomass of broad leaved weed in wheat.

The study observed significant variations in the density and biomass of broadleaf weeds across different herbicide treatments. At various growth stages of the wheat crop, the density of broadleaf weeds was meticulously recorded, with particular attention to the differences between treated and untreated plots. The application of specific broadleaf herbicides resulted in a marked reduction in both the density and biomass of these weeds, as highlighted by statistically significant differences in the data. These findings are summarized in tables and represented graphically through histograms, showcasing the efficacy of the herbicides in managing broadleaf weeds in wheat fields.

### Weed flora of the experimental field during crop season during 2021-22 & 2022-23

During the crop season, the experimental field encountered a variety of weed species (**Table No.1**) categorized into grassy weeds, non-grassy weeds, and sedges, each influencing the wheat crop's growth and yield to different extents.

The results from the experimental field highlighted significant competition from diverse weed species, each impacting wheat growth and yield differently. Grassy weeds, particularly *Avenafatua* (wild oat) and *Cynodondactylon* (Bermuda grass), were the most aggressive competitors. *Avenafatua* exhibited high density and vigorous growth, severely limiting the resources available to the wheat crop and resulting in noticeable reductions in wheat productivity. *Cynodondactylon* formed dense mats that constrained space and nutrient availability, compounding the competitive pressure on the crop. While *Phalaris* (little seed canary grass) was present, its impact was less pronounced compared to the more aggressive grassy weeds. Non-grassy weeds such as *Chenopodium album* (common lambsquarter) and *Convolvulus arvensis* (field bindweed) also posed significant challenges. *Chenopodium album* was widespread and competitive, while *Convolvulus arvensis*presented issues through shading and physical interference with wheat growth. Sedges, particularly *Cyperusrotundus* (purple nut sedge), were another critical concern due to their aggressive spreading, which further exacerbated the competitive pressure on wheat.

Effective weed management is essential to mitigate the adverse effects of these weed species on wheat cultivation. The findings underscore the need for targeted herbicide application and integrated weed management strategies to control the various weed types effectively. Herbicides must be chosen based on their efficacy against specific weed categories, considering the competitive nature of weeds like *Avenafatua* and *Cyperusrotundus*. The varying impacts of different weeds on wheat yield highlight the complexity of weed management in wheat fields and the importance of a strategic approach to optimizing crop performance and yield. Above findings are inline with the findings of Chhokar *et. al.* (2012) and Sidhu *et al.* (2000)

**Table No. - 1 : Weed flora of the experimental field during crop season during.**

| W | S. No | Botanical name | English name | Common Hindi name | Family |
|---|---|---|---|---|---|
| I | Grassy Weeds | | | | |
| | 1. | *Avenafatua* | Wild oat | Jangali jai | Poaceae |
| | 2. | *Cynodondactylon* | Bermuda grass | Doob | Poaceae |
| | 3. | *Phalaris* | Little seed canary grass | Gehunka mama ,Gullidanda | Poaceae |
| II | Non-Grassy Weeds | | | | |
| | 1. | *Anagallisarvensis* | Scortlet pimpernel | Krishnaneel | Primulaceae |
| | 2. | *Asphodelustenuifolius* | Wild onion | Piazi | Asphodeliaceae |
| | 3. | *Chenopodium album* | Common lambsquarter | Bathua | Chenopodiaceae |
| | 4. | *Convolvulus arvensis* | Field bind weed | Hirankhuri | Convolvulaceae |
| | 5. | *Coronopusdiddymus* | Lesser swine cress | Pitpara | Brassicaceae |
| | 6. | *Fumariaparviflora* | Indian fumitory | Ban soya | Fumariaceae |
| | 7. | *Lathyrusaphaca* | Wild pea | Matri | Fabaceae |
| | 8. | *Melilotusindica* | Yellow sweet clover | Peelisenji | Fabaceae |
| | 9. | *Partheniumhysterophorus* | Carrot grass/Congress grass | Gajarghass /Chandni | Asteraceae |
| | 10. | *Rumexacetocella* | Red sorrel | Khattapalak | Polygonaceae |
| | 11. | *Solanumnigrum* | Night angle sedge | Makoi | Solanaceae |
| | 12. | *Spergullaarvensis* | Corn spurry | Jangalidhania | Caryophallaceae |
| | 13. | *Vicia sativa* | Common vetch | Akra | Leguminosae |
| III | Sedges | | | | |
| | 1. | *Cyperusrotundus* | Purple nut sedge | Motha | Cyperaceae |

**Composition of grassy weeds , non-grassy weeds and sedges in weedy check at different stages.**

**Table 2** illustrates the percentage composition of grassy weeds, non-grassy weeds, and sedges in the weedy check at different growth stages of the crop for the years 2021-22 and 2022-23.

**Table No. - 2 : Percent composition of grassy weeds , non-grassy weeds and sedges in weedy check at different stages.**

| Days after sowing | Grassy Weeds | | Non-grassy Weeds | | Sedges | |
|---|---|---|---|---|---|---|
| | 2021-22 | 2022-23 | 2021-22 | 2022-23 | 2021-22 | 2022-23 |
| 30 | 6.90 | 7.32 | 75.59 | 76.12 | 17.51 | 16.56 |
| 60 | 7.35 | 7.48 | 72.89 | 72.83 | 19.76 | 19.69 |
| 90 | 6.59 | 7.41 | 73.78 | 73.21 | 19.63 | 19.38 |

The composition of weed categories in the weedy check demonstrated distinct patterns across different growth stages of wheat during the years 2021-22 and 2022-23. Grassy weeds showed relatively stable proportions with minor fluctuations. Their percentage increased slightly from 6.90% to 7.32% between 30 and 60 days after sowing in 2021-22, and from 7.32% to 7.48% in 2022-23. By 90 days after sowing, there was a slight decrease to 6.59% in 2021-22, whereas it increased to 7.41% in 2022-23. This stability suggests that while grassy weeds were present, their impact did not vary significantly over time.

In contrast, non-grassy weeds were the dominant weed category, though their proportion decreased slightly over the growth stages. Their percentage dropped from 75.59% to 72.89% between 30 and 60 days after sowing in 2021-22, and from 76.12% to 72.83% in 2022-23. By 90 days after sowing, there was a slight increase to 73.78% in 2021-22 and 73.21% in 2022-23, indicating a gradual decline in their dominance as the crop matured. Sedges, on the other hand, exhibited a steady increase over time, with their percentage rising from 17.51% to 19.76% in 2021-22 and from 16.56% to 19.69% in 2022-23 between 30 and 60 days after sowing. By 90 days, sedge percentages slightly decreased but remained higher than the initial measurements. This trend reflects the growing competitive impact of sedges on the crop. Overall, the results underscore the need for targeted management strategies to address the varying impacts of grassy weeds, non-grassy weeds, and sedges on wheat productivity.Above findings are inline with the findings of Jat*et al.* (2007)

**Relative density of major weed species at different stages in weedy check**

The relative density of major weed species in the weedy check was assessed at three stages of crop growth (30, 60, and 90 days after sowing) for the years 2021-22 and 2022-23. The data reveal distinct trends for each species.

**Table No. - 2 a : Relative density of major weed species at different stages in weedy check.**

| Weed species | 2021-22 | | | 2022-23 | | |
|---|---|---|---|---|---|---|
| | **30** | **60** | **90** | **30** | **60** | **90** |
| *Cyperusrotundus* | 17.51 | 19.76 | 19.63 | 16.56 | 19.69 | 19.38 |
| *Anagallisarvensis* | 28.78 | 26.70 | 26.63 | 29.62 | 26.77 | 27.05 |
| *Chenopodium album* | 25.59 | 25.88 | 25.32 | 25.26 | 25.38 | 24.96 |
| *Cynodondactylon* | 5.39 | 6.00 | 6.07 | 5.40 | 6.24 | 6.37 |
| *Partheniumhysterophorus* | 11.45 | 10.08 | 9.82 | 12.02 | 10.68 | 10.14 |
| other weed species | 11.28 | 11.58 | 12.53 | 11.14 | 11.24 | 12.10 |

The relative density of major weed species in the weedy check revealed distinct trends throughout the crop growth stages for the years 2021-22 and 2022-23. *Cyperusrotundus*, a prominent sedge, exhibited a slight increase in density over time, rising from 17.51% at 30 days to 19.76% at 60 days in 2021-22, and from 16.56% to 19.69% in 2022-23. Despite a minor decrease by 90 days, it remained a dominant weed, indicating its strong competitive ability throughout the growing season. *Anagallisarvensis*, on the other hand, showed a gradual decline in relative density, dropping from 28.78% at 30 days to 26.63% at 90 days in 2021-22, and similarly decreasing in 2022-23. This decline suggests that while initially significant, its impact lessened as the crop matured.

*Chenopodium album* maintained relatively stable relative density, ranging from 25.59% to 25.32% over the growth stages in 2021-22 and from 25.26% to 24.96% in 2022-23. This stability indicates its persistent presence and competitive pressure. *Cynodondactylon,* a grassy weed, showed a steady increase in density from 5.39% to 6.07% in 2021-22 and from 5.40% to 6.37% in 2022-23, reflecting its growing dominance over time. *Partheniumhysterophorus* demonstrated a decreasing trend, with its density falling from 11.45% to 9.82% in 2021-22 and from 12.02% to 10.14% in 2022-23, indicating a reduction in its competitive impact. The relative density of other weed species increased slightly, highlighting the gradual rise of various minor weed species. Overall, Cyperusrotundus and *Chenopodium album* emerged as the most persistent weeds, while *Anagallisarvensis* and *Partheniumhysterophorus* showed declines. *Cynodondactylon's* steady rise and the increase in other weed species reflect the evolving weed dynamics throughout the crop growth stages. Above findings are inline with the findings of Rahman and Mukherjee (2009)

**Effect of Various Weed Control Measures on Total Weed Density**

The impact of different weed control treatments on the total weed density per square meter was evaluated at 30, 60, and 90 days after sowing for the years 2021-22 and 2022-23. The data highlights the effectiveness of various treatments in managing weed populations.

**Table No. - 3 : Effect of various weed controls measure on total weeds density per meter square.**

| Treatments | | Rate (gm. a.e./a.i./ha) | 2021-22 | | | 2022-23 | | |
|---|---|---|---|---|---|---|---|---|
| | | | 30 days | 60 days | 90 days | 30 days | 60 days | 90 days |
| $T_1$ | 2,4 D | 600 | 175.33<br>13.26 | 106.33<br>10.35 | 115.67<br>10.78 | 174<br>13.22 | 105<br>10.28 | 111.67<br>10.67 |
| $T_2$ | Carfentrazone | 20 | 183.67<br>13.58 | 104<br>10.24 | 125.67<br>10.23 | 183.67<br>13.58 | 113<br>10.67 | 125<br>11.20 |
| $T_3$ | Carfentrazone | 30 | 180.33<br>13.46 | 92.67<br>9.67 | 100.67<br>10.07 | 179.67<br>13.43 | 93<br>9.68 | 100.67<br>10.07 |
| $T_4$ | Carfentrazone | 40 | 171.67<br>13.13 | 78.67<br>8.91 | 84.33<br>9.22 | 172<br>13.12 | 79<br>8.92 | 83.33<br>9.16 |
| $T_5$ | Florasulam | 15 | 192.33<br>13.89 | 179.67<br>13.42 | 191.33<br>13.86 | 193.33<br>13.93 | 179.33<br>13.41 | 191<br>13.84 |
| $T_6$ | Florasulam | 25 | 195<br>13.99 | 172<br>13.14 | 178.67<br>13.39 | 192.33<br>13.89 | 169.33<br>13.04 | 179.33<br>13.42 |

| Treatments | | Rate (gm. a.e./a.i./ha) | 2021-22 | | | 2022-23 | | |
|---|---|---|---|---|---|---|---|---|
| | | | 30 days | 60 days | 90 days | 30 days | 60 days | 90 days |
| $T_8$ | Florasulam | 45 | 181.33<br>13.49 | 124<br>11.16 | 134.33<br>11.62 | 181.33<br>1313.49 | 123<br>11.12 | 132.67<br>11.55 |
| $T_9$ | Metsulfuron methyl | 4 | 173.67<br>13.21 | 96.33<br>9.85 | 103.67<br>10.21 | 175.67<br>13.27 | 106.33<br>10.34 | 102.33<br>10.15 |
| $T_{10}$ | Metsulfuron methyl | 6 | 169<br>13.03 | 82.67<br>9.13 | 89.33<br>9.49 | 169.33<br>13.03 | 84.67<br>9.24 | 89.67<br>9.51 |
| $T_{11}$ | Weed free | | 00<br>1.00 | 00<br>1.00 | 00<br>1.00 | 00<br>1.00 | 00<br>1.00 | 00<br>1.00 |
| $T_{12}$ | Weedy check | | 198<br>14.09 | 244.67<br>15.64 | 258<br>16.08 | 191.33<br>13.84 | 240.33<br>15.49 | 256.33<br>16.03 |
| **C.V.** | | | 4.305 | 5.670 | 5.939 | 5.759 | 6.506 | 6.414 |
| **S. Ed. (±)** | | | 0.439 | 0.483 | 0.525 | 0.586 | 0.557 | 0.564 |
| **SE(m)** | | | 0.311 | 0.342 | 0.371 | 0.415 | 0.394 | 0.399 |
| **C. D. (P = 0.05)** | | | 0.917 | 0.1008 | 1.095 | 1.224 | 1.162 | 1.778 |

The evaluation of various weed control measures on total weed density revealed significant differences in effectiveness across treatments at 30, 60, and 90 days after sowing (DAS) for the years 2021-22 and 2022-23. At 30 DAS, Metsulfuron Methyl applied at 6 g a.e./ha ($T_{10}$) was the most effective, showing the lowest weed density of 169.00 weeds/m², followed closely by Metsulfuron Methyl at 4 g a.e./ha (T9) and Carfentrazone at 30 g a.e./ha ($T_3$), which had densities of 173.67 and 180.33 weeds/m², respectively. These treatments were significantly more effective than Florasulam at 25 g a.e./ha ($T_6$), which had a higher weed density of 195.00 weeds/m². The weed-free treatment ($T_{11}$) had no weeds, highlighting its superior effectiveness, while the weedy check ($T_{12}$) recorded the highest density of 198.00 weeds/m².

By 60 DAS, Carfentrazone at 40 g a.e./ha ($T_4$) proved the most effective, with the lowest weed density of 78.67 weeds/m². This was followed by Metsulfuron Methyl at 6 g a.e./ha ($T_{10}$) and Metsulfuron Methyl at 4 g a.e./ha ($T_9$), with densities of 82.67 and 96.33 weeds/m², respectively. These treatments were significantly more effective than Florasulam at 25 g a.e./ha ($T_6$), which had a weed density of 172.00 weeds/m². The weedy check ($T_{12}$) saw a marked increase in weed density, reaching 244.67 weeds/m², emphasizing the necessity of herbicide application for effective weed control.

At 90 DAS, Carfentrazone at 40 g a.e./ha ($T_4$) continued to show the lowest weed density of 84.33 weeds/m², followed by Metsulfuron Methyl at 6 g a.e./ha ($T_{10}$) with 89.33 weeds/m², and Metsulfuron Methyl at 4 g a.e./ha ($T_9$) with 103.67 weeds/m². These treatments remained significantly more effective than Florasulam at 25 g a.e./ha ($T_6$), which recorded a higher weed density of 178.67 weeds/m². The weed-free treatment ($T_{11}$) maintained zero weed density throughout, while the weedy check ($T_{12}$) had the highest density of 258.00 weeds/m², reinforcing the critical role of effective weed management practices in controlling weed populations and ensuring crop health. Overall, *Carfentrazone* at higher rates demonstrated superior performance in reducing total weed density, followed by *Metsulfuron Methyl* and *Florasulam,* highlighting the importance of selecting appropriate herbicides and application rates for optimal weed control.Above findings are inline with the findings of Malik *et al.* (2008)

**Effect of Various Weed Control Measures on Dry Biomass of Total Weeds**

The dry biomass of total weeds was assessed at 30, 60, and 90 days after treatment application for the years 2021-22 and 2022-23. The results highlight the efficacy of different weed control measures in reducing weed biomass.

**Table No. - 4 : Effect of various weed controls measure on Dry Biomass of total weeds**

| Treatments | | Rate (gm. a.e./a.i./ha) | 2021-22 | | | 2022-23 | | |
|---|---|---|---|---|---|---|---|---|
| | | | 30 dys | 60 days | 90 days | 30 days | 60 days | 90 days |
| $T_1$ | 2,4 D | 600 | 8.42<br>3.06 | 22.02<br>4.79 | 58.20<br>7.68 | 8.36<br>3.05 | 22.30<br>4.82 | 56.12<br>7.55 |
| $T_2$ | Carfentrazone | 20 | 8.60<br>3.09 | 20.89<br>4.67 | 61.05<br>7.86 | 8.52<br>3.07 | 20.18<br>4.59 | 62.10<br>7.93 |
| $T_3$ | Carfentrazone | 30 | 8.68<br>3.10 | 19.13<br>4.47 | 53.16<br>7.35 | 8.60<br>3.09 | 19.75<br>4.54 | 52.32<br>7.28 |
| $T_4$ | Carfentrazone | 40 | 8.28<br>3.03 | 16.76<br>4.21 | 46.28<br>6.86 | 8.24<br>3.02 | 16.48<br>4.17 | 46.02<br>6.85 |
| $T_5$ | Florasulam | 15 | 8.92<br>3.14 | 32.47<br>5.78 | 80.68<br>9.02 | 8.86<br>3.13 | 31.28<br>5.67 | 81.08<br>9.05 |
| $T_6$ | Florasulam | 25 | 9.02<br>3.16 | 31.29<br>5.67 | 78.18<br>8.89 | 9.04<br>3.16 | 32.02<br>5.74 | 76.95<br>8.82 |
| $T_7$ | Florasulam | 35 | 8.87<br>3.13 | 29.23<br>5.49 | 72.89<br>8.59 | 8.85<br>3.13 | 29.12<br>5.48 | 70.87<br>8.47 |
| $T_8$ | Florasulam | 45 | 8.64<br>3.10 | 23.98<br>4.99 | 63.82<br>8.04 | 8.58<br>3.08 | 23.09<br>4.90 | 62.20<br>7.94 |
| $T_9$ | Metsulfuron methyl | 4 | 8.36<br>3.05 | 19.76<br>4.54 | 54.20<br>7.42 | 8.26<br>3.03 | 19.27<br>4.49 | 53.80<br>7.40 |
| $T_{10}$ | Metsulfuron methyl | 6 | 8.24<br>3.03 | 17.63<br>4.31 | 49.52<br>7.10 | 8.18<br>3.02 | 17.87<br>4.34 | 50.30<br>7.13 |
| $T_{11}$ | Weed free | | 00<br>1 | 00<br>1 | 00<br>1 | 00<br>1 | 00<br>1 | 00<br>1 |
| $T_{12}$ | Weedy check | | 9.08<br>3.17 | 39.12<br>6.33 | 102.12<br>10.14 | 9,02<br>3.16 | 41.40<br>6.51 | 100.20<br>10.05 |
| **SE(m)** | | | 0.097 | 0.172 | 0.253 | 0.134 | 0.171 | 0.224 |
| **C. D. (P = 0.05)** | | | 0.286 | 0.508 | 0.747 | 0.395 | 0.505 | 0.661 |

The results of the study clearly demonstrate that Carfentrazone, particularly at higher application rates, was the most effective in reducing both weed density and biomass. This herbicide significantly outperformed other treatments, especially at 40 g a.e./ha. Metsulfuron Methyl also showed substantial efficacy, particularly at higher doses, in managing weed biomass. Florasulam treatments, while effective, generally resulted in higher weed densities and biomass compared to Carfentrazone and Metsulfuron Methyl.

The weed-free treatment (**$T_{11}$**) consistently maintained zero biomass, showcasing its superior control over weeds. Conversely, the weedy check (**$T_{12}$**) exhibited the highest weed density and biomass, underscoring the importance of effective herbicide application for optimal weed management and crop health. These findings underscore the importance of selecting appropriate herbicides and application rates for effective weed control in wheat cultivation.Above findings are inline with the findings of Bharat *et al.* (2012).

## CONCLUSION

The study on the effect of herbicides on broadleaf weed density and biomass in wheat revealed that Carfentrazone, particularly at higher application rates, was most effective in reducing both weed density and biomass, significantly outperforming other herbicides. Metsulfuron Methyl also showed substantial efficacy, especially at elevated doses. Florasulam treatments, while somewhat effective, generally yielded higher weed densities and biomass compared to Carfentrazone and Metsulfuron Methyl. The weed-free treatment demonstrated superior control, maintaining zero weed density, whereas the weedy check had the highest weed density and biomass, underscoring the importance of effective herbicide application for optimal weed management in wheat cultivation.

## FUTURE SCOPE

Future research could expand on the current study by investigating the long-term impacts of broadleaf herbicides on soil health and microbial communities, as well as their residual effects on subsequent crops. Additionally, exploring the integration of herbicide applications with other weed management practices, such as crop rotation and cover cropping, could offer insights into more sustainable and holistic approaches to weed control. Evaluating the economic implications of different herbicide treatments in diverse agro-ecological zones and under varying climatic conditions would also provide valuable information for optimizing weed management strategies. Finally, the development and testing of new herbicide formulations or alternative weed control methods could further enhance the effectiveness and environmental sustainability of weed management practices in wheat cultivation.

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# SOCIO-ECONOMIC PROFILE OF FARMERS IN EASTERN UTTAR PRADESH

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**ABSTRACT**

**This research examines the socio-economic profile of farmers in Eastern Uttar Pradesh, focusing on sugarcane and vegetable farmers. Utilizing an descriptive design and a multistage sampling method, the study involved 240 farmers from selected districts and blocks, collected between 2021 and 2023. The analysis reveals that the majority of respondents are middle-aged (62.5%), with significant experience in farming (47.9% having over 36 years). Educational attainment varies, with many having at least secondary education, although a notable portion remains illiterate. Income levels are predominantly low, with 70% earning below Rs. 45,094 annually. Land holdings are mostly marginal or small and irrigation practices predominantly involve tubal methods. Family structures favor joint families and most farmers show medium levels of social participation and mass media exposure. These findings highlight the economic challenges and diverse needs of the farming community, suggesting targeted support to improve productivity and socio-economic conditions.**

***Keywords*** **:** *Socio-economic profile, agripreneurship, environmental challenges, economic disparities, land holding, farming experience, social participation etc.*

## INTRODUCTION

Agripreneurship, the fusion of agriculture and entrepreneurship, emerges as a pivotal strategy to address the socio-economic and environmental challenges faced by farmers in Eastern Uttar Pradesh. This region, characterized by a diverse demographic and socio-economic fabric, presents a unique landscape for innovative agricultural practices and entrepreneurial ventures. The socio-economic profile of farmers here—ranging from varied age groups and educational backgrounds to differing family sizes and land holdings—highlights the multifaceted nature of agricultural livelihoods.

Eastern Uttar Pradesh faces significant issues such as stubble burning, which exacerbates environmental pollution and the need for more efficient farming practices to improve productivity and income stability. These challenges necessitate the exploration of sustainable agricultural practices, technological advancements and supportive government policies. Moreover, the region's socio-economic dynamics, including caste composition, occupational diversity and levels of education, underscore the importance of tailored interventions that can enhance agricultural output and economic resilience.

The role of agripreneurship is critical in this context, offering solutions that not only address environmental concerns but also promote economic development through value-added agricultural practices, food processing and packaging. By leveraging technological innovations and fostering entrepreneurial spirit, Eastern Uttar Pradesh can transform its agricultural sector, benefiting small landholders and marginalized communities. This introduction sets the stage for a deeper exploration of the socio-economic characteristics of farmers in the region and the potential of agripreneurship to drive sustainable growth and development.

## MATERIALS AND METHODS

The research methodology employed in this study utilized descriptive research design. This design is well suited for systematic empirical inquiries where independent variables cannot be directly manipulated. The study adopted a meticulous multistage sampling procedure to ensure a comprehensive analysis of the entrepreneurial landscape. Initially, Eastern Uttar Pradesh was selected for its diverse agro-climatic conditions andKushinagar and Varanasi districts were chosen based on their distinct agricultural practices. Specific blocks within these districts were then purposefully selected, considering factors such as sugarcane cultivation in Ramkola and Hata blocks and vegetable farming in Arajiline and Pindara blocks. From these blocks, 240 farmers were randomly selected, ensuring a representative sample for in-depth exploration.

Conducting the research between 2021 and 2023, the study aimed to provide insights into the socio-economic characteristics of farmers in Eastern Uttar Pradesh. Data collection involved surveys and interviews with selected farmers, focusing on various aspects such as family size, education level, occupation and income, along with agricultural practices. The collected data were systematically analyzed to identify patterns and draw conclusions regarding the entrepreneurial dynamics in the region. The methodological rigor, including the ex-post facto design and multistage sampling approach, ensured the validity and reliability of the study's findings, contributing to anuanced understanding of agricultural entre-preneurship and its socio-economic implications in Eastern Uttar Pradesh.

Data collected for the study ware arranged, coded and analyzed through the use of Statistical Package for the Social Sciences (SPSS) computer programme. Both descriptive and inferential statistical tools ware utilized to analyze the data.

**Table - 1 : Distribution of respondents according to their age**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Young age (Below 43 Years) | 23 | 19.2 | 19 | 15.8 | 42 | 17.5 |
| Middle age (Between 43 to 66 Years) | 75 | 62.5 | 75 | 62.5 | 150 | 62.5 |
| Old age (Above 66 Years) | 22 | 18.3 | 26 | 21.7 | 48 | 20.0 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 54.53** | **SD = 11.50** | | | **C.V. =21.10** | | |

## RESULTS AND DISCUSSION

The analysis of age distribution among sugarcane and vegetable farmers reveals that the majority of respondents (62.5%) belong to the middle-aged group (43-66 years), indicating their substantial experience and market knowledge. Younger farmers (17.5%) are more involved in sugarcane farming, likely due to the crop's profitability and their enthusiasm for agriculture. In contrast, a higher percentage of older farmers (20%) are engaged in vegetable farming, possibly due to the lower labor intensity. The findings suggest that tailored agricultural programs considering age-related needs could enhance productivity and participation across different age groups. These results align with previous studies by Shreeram (2013),Maratha *et al*. (2017), Siddique *et al*. (2023).

The educational distribution among respondents reveals that the majority of sugarcane farmers have completed High School (22.5%), while most vegetable farmers have attained Secondary education (21.7%). A significant portion of the population remains illiterate, especially among vegetable farmers (15%). However, a considerable number of respondents have pursued higher education, with 10.8% having completed Graduation and 7.9% having attained Post-Graduation or higher. These findings reflect the positive impact of governmental and non-governmental educational initiatives, though challenges remain in reducing illiteracy, particularly among older farmers. Above findings are inline with the findings of Maratha *et al*. (2017) Siddique *et al*. (2023).

**Table - 2 : Distribution of respondents according to their education**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Illiterate | 10 | 8.3 | 18 | 15.0 | 28 | 11.7 |
| Primary Secondary | 20 | 16.7 | 16 | 13.3 | 36 | 15.0 |
| Secondary | 17 | 14.2 | 26 | 21.7 | 43 | 17.9 |
| High School | 27 | 22.5 | 20 | 16.7 | 47 | 19.6 |
| Intermediate | 26 | 21.7 | 15 | 12.5 | 41 | 17.1 |
| Graduation | 10 | 8.3 | 16 | 13.3 | 26 | 10.8 |
| Post-Graduation + Others | 10 | 8.3 | 9 | 7.5 | 19 | 7.9 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |

**Table - 3 : Distribution of respondents according to their Caste**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| General Category | 34 | 28.3 | 37 | 30.8 | 71 | 29.6 |
| OBC | 59 | 49.2 | 53 | 44.2 | 112 | 46.7 |
| SC/ST | 18 | 15.0 | 19 | 15.8 | 37 | 15.4 |
| Other | 9 | 7.5 | 11 | 9.2 | 20 | 8.3 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |

The distribution of respondents reveals that the majority of sugarcane farmers (49.2%) belong to the OBC category, followed by 28.3% from the General category, 15% from SC/ST and 7.5% from other categories. A similar pattern is observed among vegetable farmers, with 44.2% in the OBC category, 30.8% in the General category, 15.8% in SC/ST and 9.2% from other groups. Overall, 46.7% of the total respondents are OBC, 29.6% are General, 15.4% are SC/ST and 8.3% belong to other categories. The higher involvement of socially and economically backward groups highlights the positive impact of government schemes aimed at supporting these communities. These findings align with those of Kumar *et al.* (2014) and Maratha *et al.* (2017).

**Table - 4 : Distribution of respondents according to their number of family members**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Low (Below 4 members) | 36 | 30.0 | 19 | 15.8 | 55 | 22.9 |
| Medium (Between 4 to 14 members) | 41 | 34.2 | 22 | 18.3 | 63 | 26.3 |
| High (Above 14 members) | 43 | 35.8 | 79 | 65.8 | 122 | 50.8 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 9.27** | **SD = 4.92** | | | **C.V. =53.05** | | |

The distribution of respondents based on family size shows that a majority (35.8%) of sugarcane farmers belong to families with more than 14 members, followed by 34.2% who have 4 to 14 members and 30% who have fewer than 4 members. A similar pattern is seen among vegetable farmers, where 65.8% belong to families with over 14 members, 18.3% to families with 4 to 14 members and 15.8% to families with fewer than 4 members.

As the distribution follows a similar pattern in both categories, the overall data reveals that 50.8% of the population belong to families with more than 14 members, around one-fourth belong to families with 4 to 14 members and 22.9% belong to families with fewer than 4 members. The significant variability in family size suggests diverse family dynamics and support systems, indicating a need for personalized approaches to leverage family support in entrepreneurial activities. These findings are consistent with those of Maratha *et al*. (2017).

**Table - 5 : Distribution of respondents according to their family type**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Joint family | 86 | 71.7 | 85 | 70.8 | 171 | 71.3 |
| Nuclear family | 34 | 28.3 | 35 | 29.2 | 69 | 28.8 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |

The distribution of respondents according to family type shows a clear preference for joint families, with 71.7% of sugarcane farmers and 70.8% of vegetable farmers living in joint families. The overall data reflects this trend, with 71.3% of respondents belonging to joint families and 28.8% to nuclear families. This pattern suggests that farmers view joint families as a vital support system, especially during uncertainties. These findings align with the studies by Rathode*et al.* (2011) and Maratha *et al.* (2017).

**Table - 6 : Distribution of respondents according to their occupation**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Farming | 38 | 31.7 | 61 | 50.8 | 99 | 41.3 |
| Farming+Govt. Job | 21 | 17.5 | 18 | 15.0 | 39 | 16.3 |
| Farming +Pvt. Job | 28 | 23.3 | 18 | 15.0 | 46 | 19.2 |
| Farming + Caste based Business | 33 | 27.5 | 23 | 19.2 | 56 | 23.3 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |

The distribution of respondents according to occupation reveals that farming is the primary occupation, with 41.3% solely engaged in agricultural activities. Among sugarcane farmers, 31.7% are solely into farming, while 50.8% of vegetable farmers follow this pattern. Farming combined with caste-based businesses is the second most common occupation (23.3%), followed by farming with private jobs (19.2%) and government jobs (16.3%). The prevalence of multiple income-generating activities may be attributed to larger family sizes, joint family structures and economic pressures such as inflation. Above results are inline with the findings of Rawal and Chandawat (2011).

**Table - 7 : Distribution of respondents according to their annual income**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Low annual income (Below 45094.51) | 96 | 80.0 | 72 | 60.0 | 168 | 70.0 |
| Medium annual income (Between 45094.51 to 210155.49) | 11 | 9.2 | 35 | 29.2 | 46 | 19.2 |
| High annual income (Above 210155.49) | 13 | 10.8 | 13 | 10.8 | 26 | 10.8 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 127625** | **SD = 82530.49** | | | **C.V. =64.67** | | |

The distribution of respondents according to annual income indicates that a significant majority, 70%, earn below Rs. 45,094.51 annually, with 80% of sugarcane farmers and 60% of vegetable farmers falling into this category. Only 19.2% of respondents earn between Rs. 45,094.51 and Rs. 210,155.49 and a mere 10.8% earn above Rs. 210,155.49. This suggests a high economic disparity among respondents, with many facing low-income challenges. The high income variability highlights the need for targeted financial support and resource allocation to assist lower-income groups. These findings align with Malliga (2008) and Siddique *et al.* (2023).

**Table - 8 : Distribution of respondents according to their land holding**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Marginal farmers (less than 1 ha. land) | 27 | 22.5 | 46 | 38.3 | 73 | 30.4 |
| Small farmers (1-2 ha. land) | 32 | 26.7 | 23 | 19.2 | 55 | 22.9 |
| Semi-medium farmers (2-4 ha. land) | 23 | 19.2 | 17 | 14.2 | 40 | 16.7 |
| Medium farmers (4-10 ha. land) | 19 | 15.8 | 30 | 25 | 49 | 20.4 |
| Large farmers (more than 10 ha. land) | 19 | 15.8 | 4 | 3.3 | 23 | 9.6 |
| **Pool data** | **240** | **100.0** | **240** | **100.0** | **240** | **100.0** |
| **Mean = 2.56** | **SD = 1.36** | | | **C.V. =53.11** | | |

Table 8 reveals that land holdings are predominantly small to marginal among both sugarcane and vegetable farmers. For sugarcane farmers, 26.7% are small farmers (1-2 ha) and 22.5% are marginal farmers (<1 ha). Vegetable farmers show a higher proportion of marginal farmers (38.3%) and small farmers (19.2%). Overall, 30.4% of respondents are marginal farmers, 22.9% are small farmers, 20.4% are medium farmers (4-10 ha), 16.7% are semi-medium farmers (2-4 ha) and 9.6% are large farmers (>10 ha). This distribution indicates significant land fragmentation, which may limit access to advanced farming techniques and affect productivity. Tailored support and land management strategies are needed to address the diverse needs of farmers. These findings align with Pal *et al.* (2017).

**Table - 9 : Distribution of respondents according to their farming experience**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | F | % | F |
| Below 14 Years Farming Experience | 27 | 22.5 | 20 | 16.7 | 47 | 19.6 |
| Between 14 to 36 Years Farming Experience | 38 | 31.7 | 40 | 33.3 | 78 | 32.5 |
| Above 36 Years Farming Experience | 55 | 45.8 | 60 | 50.0 | 115 | 47.9 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 25.28** | **SD = 11.59** | | | **C.V. =45.86** | | |

Table 9 shows that a substantial portion of respondents have significant farming experience. Among sugarcane farmers, 45.8% have over 36 years of experience, while 31.7% have 14 to 36 years and 22.5% have less than 14 years. For vegetable farmers, 50% have over 36 years of experience, 33.3% have 14 to 36 years and 16.7% have less than 14 years. Overall, 47.9% of respondents have more than 36 years of experience. This extensive experience contributes to better problem-solving and management skills in agriculture. Customized support and training programs should address both novice and experienced farmers to maximize effectiveness. The above results were obtained by following the work of Maratha *et al*. (2017)

**Table - 10 : Distribution of respondents according to their uses source of irrigation**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| River/Canal | 36 | 30.0 | 37 | 30.8 | 73 | 30.41 |
| Tubewell | 46 | 38.3 | 45 | 37.5 | 91 | 37.92 |
| Submersible | 38 | 31.7 | 38 | 31.7 | 76 | 31.67 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |

Table 10 reveals that most respondents use tubal irrigation, with 37.92% relying on it, followed by 31.67% using Submersible pump and 30.41% depending on River/Canal sources. Among sugarcane farmers, 38.3% use tubewell, 31.7% use Submersible and 30% use River/Canal. For vegetable farmers, 37.5% use tubewell, 31.7% use Submersible and 30.8% use River/Canal. The reliance on artificial irrigation methods highlights the importance of irrigation infrastructure. Tailored solutions are needed to address the diverse irrigation needs and improve water management for both natural and artificial sources. The above results were obtained by following the work of Maratha *et al*. (2017)

**Table - 11 : Distribution of respondents according to their level of social participation**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Low Level Participation (Below 8.28) | 16 | 13.3 | 26 | 21.6 | 42 | 17.5 |
| Medium Level Participation (Between 8.28 to 11.05) | 83 | 69.2 | 76 | 63.3 | 159 | 66.25 |
| High Level Participation (Above 11.05) | 21 | 17.5 | 18 | 15 | 39 | 16.25 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 9.67** | **SD = 1.38** | | | **C.V. =14.31** | | |

Table 11 shows that the majority of respondents have a medium level of social participation, with 69.2% of sugarcane farmers and 63.3% of vegetable farmers falling into this category. High social participation is reported by 17.5% of sugarcane farmers and 15% of vegetable farmers, while low participation is noted by 13.3% and 21.6%, respectively. Across all respondents, 66.25% exhibit medium participation, while 17.5% and 16.25% have low and high levels of participation. The high proportion of medium-level participation indicates a generally engaged and socially active group. This uniformity in social participation suggests shared community norms and can guide targeted community-based programs.

**Table - 12 : Distribution of respondents according to their source of information utilization**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Low Level (Below 40.24) | 21 | 17.5 | 27 | 22.5 | 48 | 20 |
| Medium Level (Between 40.24 to 62.96) | 69 | 57.5 | 69 | 57.5 | 138 | 57.5 |
| High Level (Above 62.96) | 30 | 25.0 | 24 | 20.0 | 54 | 22.5 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 51.60** | **SD = 11.36** | | | **C.V. =22.02** | | |

Table 12 reveals that 57.5% of respondents, including both sugarcane and vegetable farmers, utilize information sources at a medium level. About 25% of sugarcane farmers and 22.5% of vegetable farmers use information sources at a high level, while 17.5% of sugarcane farmers and 20% of vegetable farmers report low utilization. Overall, 57.5% of respondents have medium information utilization, with 22.5% at a high level and 20% at a low level. Effective information utilization is crucial for staying updated with market trends and practices. The variability in utilization underscores the need for a multi-channel communication strategy to reach all farmers effectively. Above findings are inline with the findings of Sharma *et al.* (2014).

**Table - 13 : Distribution of respondents according to their level of mass media exposure**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Low Level Participation (Below 6.23) | 21 | 17.5 | 6 | 5.0 | 27 | 11.3 |
| Medium Level Participation (Between 6.23 to 9.48) | 57 | 47.5 | 78 | 65.0 | 135 | 56.3 |
| High Level Participation (Above 9.48) | 42 | 35.0 | 36 | 30.0 | 78 | 32.5 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 7.85** | **SD = 1.63** | | | **C.V. =21.62** | | |

Table 13 shows that 56.3% of respondents have a medium level of mass media exposure, while 32.5% have high exposure and 11.3% have low exposure. Among sugarcane farmers, 47.5% have medium exposure, 35% have high exposure and 17.5% have low exposure. For vegetable farmers, 65% report medium exposure, 30% high exposure and 5% low exposure. The majority of respondents are either moderately or highly exposed to mass media, reflecting widespread access to affordable media technologies like mobile phones and TVs. The variation in exposure levels suggests a need for diverse media strategies to effectively reach all audiences. Above findings are inline with the findings of Baliwada*et al.*(2017).

**Table - 14 : Distribution of respondents according to their value orientation**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Low (Below 14.31) | 40 | 33.33 | 52 | 43.34 | 92 | 38.3 |
| Medium (Between 14.31 to 19.38) | 60 | 50 | 44 | 36.66 | 104 | 43.3 |
| High (Above 19.38) | 20 | 16.67 | 24 | 20 | 44 | 18.3 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 16.85** | **SD = 2.53** | | | **C.V. =15.04** | | |

Table 14 shows that 50% of sugarcane farmers and 43.3% of vegetable farmers have a medium level of value orientation. Low value orientation is observed in 33.3% of sugarcane farmers and 43.3% of vegetable farmers, while high value orientation is reported by 16.67% of sugarcane farmers and 20% of vegetable farmers. Overall, 43.3% of respondents have a medium level, 38.3% a low level and 18.3% a high level of value orientation. The predominance of medium and low value orientations suggests a common set of values among respondents, which could facilitate targeted support and cohesive community initiatives. Results are consistent with Shreeram's (2013) findings.

**Table - 15 : Distribution of respondents according to their level of extension participation**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Low Level Participation (Below 8.32) | 15 | 12.5 | 11 | 9.2 | 26 | 10.8 |
| Medium Level Participation (Between 8.32 to12.60) | 80 | 66.7 | 70 | 58.3 | 150 | 62.5 |
| High Level Participation (Above 12.60) | 25 | 20.8 | 39 | 32.5 | 64 | 26.7 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 10.46** | **SD = 2.53** | | | **C.V. = 20.46** | | |

Table 15 shows that 66.7% of sugarcane farmers and 58.3% of vegetable farmers have a medium level of extension participation, with 20.8% and 32.5% having a high level, respectively. Low extension participation is reported by 12.5% of sugarcane farmers and 9.2% of vegetable farmers. Pooled data reveals that 62.5% of respondents have medium-level participation, 26.7% high-level and 10.8% low-level participation. The predominance of medium and high levels of extension participation indicates active engagement with extension programs, crucial for adapting entrepreneurial practices. The variability highlights the need for tailored outreach to enhance participation. Findings align with Shiruret *al*. (2017).

**Table: 16. Distribution of respondents according to their ability to co-ordinate farming**

| Category | Sugarcane farmers | | Vegetable Farmers | | Pool data | |
|---|---|---|---|---|---|---|
| | F | % | F | % | F | % |
| Low (Below 4.41) | 7 | 5.8 | 7 | 5.8 | 14 | 5.8 |
| Medium (Between 4.41 to 7.41) | 71 | 59.2 | 71 | 59.2 | 142 | 59.2 |
| High (Above 7.41) | 42 | 35.0 | 42 | 35.0 | 84 | 35 |
| **Pool data** | **120** | **100.0** | **120** | **100.0** | **240** | **100.0** |
| **Mean = 5.91** | **SD = 1.50** | | | **C.V. =25.35** | | |

Table 16 indicates that 59.2% of both sugarcane and vegetable farmers have medium abilities to coordinate farming activities, while 35% exhibit high abilities and 5.8% have low abilities. The pooled data mirrors this pattern, with 59.2% of respondents showing medium coordination skills, 35% high and 5.8% low. The findings suggest that most farmers have moderate to high coordination skills, with minimal low-level coordination. This moderate variability in coordination skills highlights the need for targeted skill-building programs to enhance organizational abilities among farmers. These results align with Kumar and **Goyal** (2021), Gamit*et al.* (2015) and Martha *et al.* (2016).

## CONCLUSION

The research provides a comprehensive socio-economic profile of farmers in Eastern Uttar Pradesh, emphasizing the significance of agripreneurship in addressing regional challenges. The findings reveal a predominance of middle-aged, moderately educated and economically diverse farmers engaged in varied agricultural practices. A substantial proportion of the population faces low-income levels and relies heavily on marginal to small landholdings, highlighting the need for targeted interventions. The majority of respondents exhibit moderate to high levels of social and extension participation, suggesting a receptive attitude towards agricultural innovations and community-based programs.

Agripreneurship emerges as a crucial strategy to enhance productivity and economic stability. By integrating technological advancements, value-added practices and tailored support mechanisms, agripreneurship can drive sustainable growth and development in the region. The diverse socio-economic characteristics underscore the necessity for customized solutions that address age, education, landholding and income disparities. Future policies and programs should focus on improving financial support, educational outreach and land management to foster a more resilient and prosperous agricultural sector in Eastern Uttar Pradesh.

## FUTURE SCOPE

Future research on agripreneurship in Eastern Uttar Pradesh could focus on evaluating the impact of emerging technologies like precision farming and AI on productivity and sustainability. It should also assess the effectiveness of government policies, explore the development of market linkages and value chains and investigate climate change adaptation strategies. Additionally, studying the impact of entrepreneurial training programs, socio-cultural factors and conducting longitudinal studies to track socio-economic changes over time would provide valuable insights. Comparative analyses with other regions could further enrich understanding and guide scalable strategies for agricultural and economic development. By fostering collaboration between researchers, policymakers and grassroots organizations, future endeavors can contribute to the sustainable development of agriculture and rural economies in Eastern Uttar Pradesh.

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# TO STUDY THE EFFECT OF FORTIFICATION ON QUALITY AND STORABILTY OF AONLA BEVERAGES (EMBLICA OFFICINALIS GAERTN)

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**ABSTRACT**

**The studies on extraction and storage of aonla *(Emblica officinalis Gaertn)* juice standardization of recipe for aonla juice based beverages were conducted at the Post harvest Technology Laboratory, Department of Horticulture, Kulbhaskar Ashram P.G. College, Prayagraj, during the year 2023-2024. The aonla pulp treated with pectinase-A at 2g/kg for 12 hours had maximum juice recover (88.35%) v.4th better quality parameters (TSS 10.38%, acidity 1.98%, pH 3.85%, ascorbic acid-293.96 mg/100g, reducing sugar 1.48%, non-reducing sugar 8.26%, total sugar 10.17%, sugar acid ratio 5.44). The organoleptic scores (out of 5.0) for juice were 3.23 for colour and appearance, 2.73 for taste, 2.62 for flavour and 2.81 for overall acceptability. The RTS having a recipe of 12% aonla juice + 2% lime juice + 1% ginger + sugar adjusted to a TSS of 15°B was found to be acceptable width organoleptic scores (out of 5.0) of 3.69 for colour and appearance 3.47 for taste, 3.35 for flavour and overall acceptability^ The squash having a recipe of 30%o aonla juice + 5% lime juice + 2% ginger + sugar adjusted to a TSS of 40°B was found to be acceptable with organoleptic scores (out of 5.0) of 3.73 for colour and appearance, 3.67 for taste, 3.69 for flavour and overall acceptability The syrup having a recipe of 45% aonla juice + 10% lime juice + 4% ginger + sugar adjusted to a TSS of 68°B v/as found to be acceptable width organoleptic scores (out of 5.0) of 381 for colour and appearance, 3.50 for taste, 3.24 for flavour and 3.38 for overall acceptability.**

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***Keywords :*** *Aonla, effect, study.*

## INTRODUCTION

Fresh aonla fruits are sour and astringent in taste. Hence, it is not consumed as a table fruit. The excellent nutritive and therapeutic values of this fruit offer a great potential for processing into quality products. Aonla fruits may be utilized for the processing of several value added products such as preserve, candy, herbal jam, herbal syrup, pickle, chutney, sauce (aonla + tomato), toffee, shreds and powder (Singh, 1997). Fruits are also utilized for making the Ayurvedic medicines, such as Chavanprash, Trifala churna, Amla Ki Rasayan and Powder, which are good for the diabetic patients.

The fruits is highly nutritive and it is the richest source of vitamin 'C' among the fruits except Barbados Cherry (Asenjo, 1953). It is also a rich source of pectins and tannins. Aonla fruits contain 89 to 94% pulp, 0.8 to 2 fibre, 10 to 14% total soluble solids, 1.4 to 2.4% acidity, 700 to 900 mg/100 g vitamin C, 2.4 to 3.1% pectin and 2 to 3% phenols, (Singh et al. 1993).

It is more popular in India and is commercially cultivated in Uttar Pradesh, where it is largely cultivated in commercial orchards in Azamgarh, Pratapgarh, Varanasi and Bareilly districts and also grown in Gujarat, Maharashtra and West Bengal. In view of its diverse uses, its cultivation is increasing fast and the tree is becoming popular with the orchardists. It has acquired wide popularity all over the world due to its medicinal properties and is frequently recommended in both the Ayurvedic and Unani systems of medicines.

Therefore, the present investigation was undertaken to prepare the aonla products, viz, juice, juice based beverages with the following objective :-

To standardize recipe for aonla juice based beverages.

## MATERIALS AND METHODS

The investigation "to study the effect of fortification on quality and storability of aonla ("Emblica officinalis Gaertn") beverages" was carried out in the Post-harvest Technology Laboratory of the Department of Horticulture, Kulbhaskar Ashram Post Graduate college, Prayagraj during the year 2023-2024.

## EXPERIMENT

### Standardization Of Recipe For Aonla Juice Based Beverages (trs, Squash And Syrup)

The experiment was laid out in completely Randomized Design (CRD) with three replications. There were 9 treatments in RTS, 10 treatments in squash and 9 treatments in syrup. The details of treatments are :

**RTS**

| | | |
|---|---|---|
| $T_1$ : | 10% aonla juice + 1% lime juice + 0.5% ginger + spices* | TSS $15^0$B |
| $T_2$ : | 10% aonla juice + 2% lime juice + 1.0% ginger + spices | TSS $15^0$B |
| $T_3$ : | 10% aonla juice + 3% lime juice + 1.5% ginger + spices | TSS $15^0$B |
| $T_4$ : | 12% aonla juice + 1% lime juice + 0.5% ginger + spices | TSS $15^0$B |
| $T_5$ : | 12% aonla juice + 2% lime juice + 1.0% ginger + spices | TSS $15^0$B |
| $T_6$ : | 12% aonla juice + 3% lime juice + 1.5% ginger + spices | TSS $15^0$B |
| $T_7$ : | 14% aonla juice + 1% lime juice + 0.5% ginger + spices | TSS $15^0$B |
| $T_8$ : | 14% aonla juice + 2% lime juice + 1.0% ginger + spices | TSS $15^0$B |
| $T_9$ : | 14% aonla juice + 3% lime juice + 1.5% ginger + spices | TSS $15^0$B |

*Cumin - 0.25%, Cardamom 0.25%, Black pepper 0.1%

**Squash**

| | | |
|---|---|---|
| $T_1$ : | 25% aonla juice | TSS $40^0$B |
| $T_2$ : | 25% aonla juice + 5% lime juice + 2% ginger | TSS $40^0$B |
| $T_3$ : | 25% aonla juice + 7% lime juice + 2.5% ginger | TSS $40^0$B |
| $T_4$ : | 30% aonla juice + 5% lime juice + 2% ginger | TSS $40^0$B |
| $T_5$ : | 30% aonla juice + 7% lime juice + 2.5% ginger | TSS $40^0$B |
| $T_6$ : | 25% aonla juice | TSS $50^0$B |

$T_7$ : 25% aonla juice + 5% lime juice + 2% ginger TSS $50^0$B

$T_8$ : 25% aonla juice + 7% lime juice + 2.5% ginger TSS $50^0$B

$T_9$ : 30% aonla juice + 5% lime juice + 2% ginger TSS $50^0$B

$T_{10}$ : 30% aonla juice + 7% lime juice + 2.5% ginger TSS $50^0$B

**Syrup**

$T_1$ : 45% aonla juice TSS $68^0$B

$T_2$ : 45% aonla juice + 5% lime juice + 2% ginger TSS $68^0$B

$T_3$ : 45% aonla juice + 10% lime juice + 4% ginger TSS $68^0$B

$T_4$ : 50% aonla juice TSS $68^0$B

$T_5$ : 50% aonla juice + 5% lime juice + 2% ginger TSS $68^0$B

$T_6$ : 50% aonla juice + 10% lime juice + 4% ginger TSS $68^0$B

$T_7$ : 55% aonla juice TSS $68^0$B

$T_8$ : 55% aonla juice + 5% lime juice + 2% ginger TSS $68^0$B

$T_9$ : 55% aonla juice + 10% lime juice + 4% ginger TSS $68^0$B

## RESULTS AND DISCUSSION

**Evaluation of recipe for R.T.S. :-**

**Aonla R.T.S. :-**

The data on organoleptic characters fiz; colour and appearance, taste, flavour and overall acceptability of aonls RTS as influenced by different treatments are presented in Table-1. The results indicated that there was a significant difference between the treatments with respect to colour and appearance, taste, flavour and overall acceptability of aonla RTS.

Significantly highest score for colour and appearance was observed in $T_s$ (3.86) followed by $T_5$ (3.69%) whereas least score was recorded in $T_1$ (3.27).

Significantly highest score for taste was observed in $T_5$ (3.47) followed by $T_7$ (3.38) whereas least score was recorded in $T_3$ (2.82). Significantly highest score for overall acceptability of aonla RTS was observed in $T_5$ and $T_7$ (3.35) followed by $T_2$, T and $T_9$ (3.18), where as least score was recorded in T8 (2.78).

**Table - 1 : Organoleptic evaluation of aonla RTS as influenced by treatments. (Scores out of 5.0)**

| Treatment | Colour and appearance | Taste | Flavour | Overall acceptability |
|---|---|---|---|---|
| $T_1$ | 3.27 | 3.05 | 3.12 | 3.13 |
| $T_2$ | 3.45 | 3.29 | 3.21 | 3.18 |
| $T_3$ | 3.47 | 2.82 | 2.94 | 2.97 |
| $T_4$ | 3.38 | 3.12 | 3.00 | 3.18 |
| $T_5$ | 3.69 | 3.47 | 3.35 | 3.35 |
| $T_6$ | 3.60 | 3.28 | 3.25 | 3.13 |
| $T_7$ | 3.60 | 3.38 | 3.26 | 3.35 |
| $T_8$ | 3.86 | 3.07 | 3.25 | 2.78 |
| $T_9$ | 3.45 | 3.29 | 3.21 | 3.18 |
| Mean | 3.53 | 3.20 | 3.18 | 3.14 |
| S-Emt<br>C D (0.01). | 0.053<br>0.216 | 0.058<br>0.236 | 0.058<br>0.236 | 0.058<br>0.236 |

**Aonla Squash :-**

**Organoleptic evaluation of aonla squash :=**

The data on organoleptic evaluation of aonla squash like colour and appearance, taste flavour and overall acceptability of aonla squash as influenced by different treatments are presented in Table-2.

The results indicated that there was a significant difference between the treatments with respect to colour and appearance observed T (3.88%) highest score, least score was recorded in $T_5$, (3.26). Significantly highest score for taste was observed in T (3.67) followed by $T_{10}$ (3.63), whereas least score was recorded in $T_6$ (2.84). Significantly highest score for flavour was recorded in $T_{10}$ (3.81) followed by T (3.69) whereas least score was recorded in $T_6$ (2.61). Significantly highest score for overall acceptability was recorded in T (3.69) followed by $T_{10}$ (3.65) whereas least overall acceptability was observed in $T_6$ (2.81).

**Table - 2 : Organoleptic evaluation of aonla squash as influenced by treatments. (Scores out of 5.0)**

| Treatment | Colour and appearance | Taste | Flavour | Overall acceptability |
|---|---|---|---|---|
| $T_1$ | 3.88 | 2.96 | 2.73 | 2.85 |
| $T_2$ | 3.60 | 3.19 | 3.27 | 3.15 |
| $T_3$ | 3.54 | 3.50 | 3.16 | 3.33 |
| $T_4$ | 3.73 | 3.67 | 3.69 | 3.69 |
| $T_5$ | 3.26 | 3.01 | 2.84 | 2.88 |
| $T_6$ | 3.34 | 2.84 | 2.61 | 2.81 |
| $T_7$ | 3.54 | 3.11 | 2.96 | 3.08 |
| $T_8$ | 3.50 | 3.33 | 2.81 | 3.15 |
| $T_9$ | 3.65 | 3.04 | 3.15 | 3.38 |
| Mean | 3.57 | 3.23 | 3.10 | 3.20 |
| S-Emt<br>C D (0.01). | 0.058<br>0.233 | 0.058<br>0.233 | 0.058<br>0.233 | 0.058<br>0.233 |

**Aonla Syrup :-**

**Organoleptic Evaluation of aonla syrup:-**

The data on organoleptic evaluation of aonla syrup like colour and appearance, taste, flavour and overall acceptability of aonla syrup as influenced by different treatments are presented in Table-3.

The results indicated that there was a significant difference between the treatments with respect to colour and appearance, taste, flavour and overall acceptability of aonla syrup.

Significantly highest score for colour and appearance was observed in $T_9$ (4.03) followed by $T_1$ (4.00). Whereas least score was recorded in $T_8$ (3.63).

Significantly highest score for taste was observed in $T_9$(3.59) flowed by $T_3$ (3.50), whereas least score was recorded in $T_4$(2.34). Significantly highest score for flavour was recorded in $T^9$ (3.59) followed by $T_3$ (3.24), whereas least score was recorded in $T_1$ (2.56). Significantly highest score for flavour was recorded in $T_9$ (3.59) followed by $T_3$ (3.24), whereas least score was recorded in $T_1$ (2.56).

**Table - 3 : Organoleptic evaluation of aonla syrup as influenced by treatments. (Scores out of 5.0)**

| Treatment | Colour and appearance | Taste | Flavour | Overall acceptability |
|---|---|---|---|---|
| $T_1$ | 4.00 | 2.81 | 2.56 | 2.85 |
| $T_2$ | 3.88 | 3.00 | 2.88 | 2.98 |
| $T_3$ | 3.81 | 3.50 | 3.24 | 3.38 |
| $T_4$ | 3.75 | 2.34 | 2.72 | 2.66 |
| $T_5$ | 3.75 | 3.19 | 3.00 | 2.97 |
| $T_6$ | 3.71 | 3.29 | 2.86 | 2.93 |
| $T_7$ | 3.81 | 3.06 | 2.81 | 3.22 |
| $T_8$ | 3.63 | 3.23 | 3.03 | 3.40 |
| $T_9$ | 4.03 | 3.59 | 3.59 | 3.61 |
| Mean | 3.82 | 3.11 | 2.97 | 3.11 |
| S-Emt<br>C D (0.01). | 0.058<br>0.233 | 0.058<br>0.233 | 0.062<br>0.249 | 0.106<br>0.426 |

Significantly highest score for overall acceptability was recorded in $T_9$(3.61) followed by $T_8$ (3.40) whereas least score was observed in $T_4$(2.66).

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# STUDIES ON THE EFFECT OF NANO UREA ON GROWTH, YIELD, AND QUALITY OF VEGETABLE PEA (PISUM SATIVAM L.) CV. KASHI UDAI

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## ABSTRACT

**The present field experiment entitled "Studies on the effect of nanourea on growth, yield, and quality of vegetable pea (*Pisum sativam L.*) cv. Kashi Udai "at Kulbhaskar Ashram Post Graduate College, Prayagraj during rabi season of the year 2023-24. The experiment was laid out in a random block design with 3 replication and 8 treatments. $T_1$ 100% RDF (40:60:30 NPK kg/hac.,$T_2$ 25% RDF of N through prilled urea + 0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_3$ 25% RDF of N through prilled urea + 0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_4$ 50% RDF of N through prilled urea + 0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_5$ 50% RDF of N through prilled urea + 0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_6$ 75% RDF of N through prilled urea + 0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_7$ 75% RDF of N through prilled urea + 0.4% nano urea foliar spray at 60days after sowing, $T_8$ nano urea foliar spray at 30 days after sowing.**

***Keywords :*** *Vegetable pea, nano urea, growth, yield, quality.*

## INTRODUCTION

Vegetable Pea (*Pisum sativam L.*) is an Important legume crop grown for its green pod. Vegetable pea belongs to the family Leguminosae. Chromosome number of (2n=14). Although it is a Genus of the Pisum. Vegetable pea native of Central Asia is of very ancient origin and its wild Prototype has never. It is an annual herbaceous which climbs by leaf let tendrils.

The main vegetable pea growing state India are Uttar Pradesh, Madhya Pradesh, Punjab, Jharkhand, Himanchal Pradesh, West Bangal, Chhattisgarh, Haryana, Uttarakhand, Manipur, Bihar. Vegetable pea growing state except Uttar Pradesh which ranks first as for area and production are concerned. The world production in vegetable pea China (12.2 MT), USA (0.31MT), France (0.23MT), and Egypt (0.15MT). Other countries are United Kingdom, Pakistan, Algeria, Peru and Turkey.

Vegetable pea is highly nutritive containing percentage of digestible protein along with carbohydrate, vitamins, minerals, amino acid and sugar. Moisture (72.0g), Carbohydrate (15.8g), Protein (7.2g), Fiber (4.0 g), Minerals (0.8g), Vitamin A (139 IU), Vitamin $B_1$ (0.25 mg) and

Vitamin C (9 mg) per 100 gram. It is an excellent food for human consumption taken as a vegetable soup and other dishes. It is also canned, frozen or dehydrated for consumption in off-season. Being highly proteinous it is quite valuable in vegetarian diet. Vegetable pea is most important crop which helps in weight management, stomach, cancer prevention, good for heart, preventing constipation, reduce cholesterol, good for bone health, immune strength, regulating blood sugar etc. The stem is circular, weak and leaves are pinnate with up to 3 pairs of leaflets and terminal branches.The flower are solitary, axillary, bear in single are a group of white colour. Pods are swollen 8-10 cm long with as many as 10 seeds. Cultiver Kashi udai has been chosen to examine response of nitrogen. The growth and development are greatly regulated by environmental and cultural factors. Environmental factors viz. temperature, light, humidity etc. effect the seed germination general survival and development of seedlings. Quality of produce depends upon occurrence of disease and pest. Cultural practices (agro-technique) such as optimum sowing date, optimum specing, number and frequency of irrigation, nutrient management etc. play vital role in raising yield.

Efficient nutrient management and expertise feeding is the need of the hour not only for increasing the productivity and production of quality pea but also for maintaining and sustaining a level of soil fertility through complementary use of chemical fertilizers in combination of nano fertilizers. Among plant nutrients nitrogen play major role in growth and development. Nitrogen is the main constituent of plant chlorphyll and amino acid that is why it greatly grown plant metabolism. Pea is legume crop and capable to fix atmospheric nitrogen in the soil. There for judieious and expertise application of nitrogen is the more precautions to production of quality pod. Nano urea is a nano technology based revolutionary agri-input which provides nitrogen to plants. When compared to conventional urea prill, it has a desirable particle size of about 20- 50 nm and more suraface area (10,000 times over 1 mm urea prill) and number of particles (55,000 nitrogen particles over 1mm urea prill). Spray during morning or evening hours avoiding dew. It is a repet spray, if rain occurs within 12 hours of nano urea spray. Nano urea dew is recommended for application only as a foliar spray at critical growth stage of crops.

Benefits of nano urea is produced by an energy efficient environmental friendly production process with less carbon, increased availability to crop by more than 80% resulting in higher nutrient use efficiency. Its foliar application to crops productivity benefits in terms of better soil, air and water and farmers profitability. Foliar spraying on leaves stimulates a range of enzymes like nitrase and nitrite, which help plants metabolic nitrogen. Cost to farmers will come down. Being smaller in packing, the farmer on its transporation and storage will also be reduced. This will eventually lead to an increase in farmers income. A large portion of conventional fertilizers like urea is lost to the atmosphere or surface water bodies, there by polluting the ecosystem. The main aim of investigation was find out of the" Effect of the nano urea on growth, yield and quality of vegetable pea".

## MATERIALS AND METHODS

The experiment was conducted at the farm of Department of Horticulture, Kulbhaskar Ashram Post Graduate College, Prayagraj, Uttar Pradesh during rabi season 2023-2024. The experiment was laid out in random block design in 3 replication and 8 treatments. $T_1$ 100% RDF (40:60:30 NPK kg/hac., $T_2$ 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60days after sowing, $T_3$ 25%

RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_4$ 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_5$ 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_6$ 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing, $T_7$ 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing, $T_8$ nano urea foliar spray at 30 days after sowing. Total no. of plots 24, Row to Row distance 45cm, Plant to Plant distance10cm, Size of plot 3X2.25m.=6.75m$^2$.

The observation was recorded in Height of plant, Length of pod, Fresh weight of pod, Number of green grains per pod, Fresh weight of green grain per pod, Fresh weight of green shells per pod, shelling percentage, Number of green pods per plant, Weight of green pod per plot, Yield of pods per plant.

## RESULTS AND DISCUSSION

## GROWTH CHARACTERS

### Height of plant (cm)

Height of plants significantly increased with application of all treatments except $T_1$ and $T_4$. The maximum height of pea plants was recorded (73.39cm) with application of $T_7$ (75% RDF of N through prilled urea+ 0.4% nano urea foliar spray at 60 days after sowing), while height of plants with $T_3$, $T_6$, and $T_8$ were noted at par foliar feeding of nano urea improve the height of plants whereas other higher does i.e. $T_3$ and $T_6$ were noted something decline effect. The highest increased percentage of plants height (28.18) was observed with feeding of $T_7$ followed by $T_6$. It was also noticed that height of plants did not influenced significantly under treatments of $T_1$ and $T_4$.

**Table - 1: Plant Height**

| Treatments | | Height at spraying | Height at last picking | Increased growth (%) |
|---|---|---|---|---|
| T1 | 100% RDF (40:60:30 NPK kg/ha-1) | 56.40 | 63.83 | 13.17 |
| T2 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 58.99 | 67.15 | 13.78 |
| T3 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 58.22 | 71.48 | 22.72 |
| T4 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60days after sowing | 57.88 | 70.94 | 22.51 |
| T5 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 57.23 | 68.08 | 15.30 |
| T6 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 56.51 | 71.37 | 26.24 |
| T7 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing | 59.03 | 73.39 | 28.18 |
| T8 | 0.4% nano urea foliar spray at 30 days after sowing | 58.16 | 72.32 | 24.30 |
| **F-test** | | S | S | S |
| **S.Ed.(±)** | | 0.494 | 0.555 | 0.703 |
| **SE(m)** | | 0.349 | 0.392 | 0.497 |
| **C.D.(P=0.05)** | | 0.987 | 1.110 | 1.406 |

## Length of pod

Length of pod was found to influence by all treatments of nano urea application showed significant increase in length of pod at each picking stage. Only T1 exhibit non significant effect on pod length. The highest and significant pod length 8.22, 7.88 and 7.38 was recorded with application of T8 (0.4% nano urea foliar spray at 30 days after sowing) at 1st, 2nd and 3rd picking stages respectively. The other treatments levels (T3, T5, and T6) were also recovered significant pod length of each picking stage. It is clear from table that expect T1 and T5, all N treatments exhibit pod length significantly at per at all picking stages. The data on pod length recorded at different stages showed that maximum pod length obtained at 1 picking in all treatments in comparison to 2nd and 3rd picking. Similarly, pod length at 2nd picking recorded height in all treatments in comparison to 3rd picking.

**Table - 2 : Length of pod**

| Treatments | | At 1st picking | At 2nd Picking | At 3rd Picking | Mean |
|---|---|---|---|---|---|
| T1 | 100% RDF (40:60:30 NPK kg/ha-1) | 7.38 | 7.11 | 6.90 | 7.13 |
| T2 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 7.55 | 7.31 | 7.07 | 7.31 |
| T3 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 7.42 | 7.18 | 6.94 | 7.18 |
| T4 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 7.82 | 7.58 | 7.34 | 7.58 |
| T5 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 7.75 | 7.51 | 7.27 | 7.51 |
| T6 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 7.75 | 7.51 | 7.27 | 7.51 |
| T7 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing | 7.88 | 7.64 | 7.40 | 7.64 |
| T8 | 0.4% nano urea foliar spray at 30 days after sowing | 8.22 | 7.98 | 7.74 | 7.98 |
| **F-test** | | S | S | S | S |
| **S.Ed.(±)** | | 0.170 | 0.181 | 0.096 | 0.181 |
| **SE(m)** | | 0.120 | 0.128 | 0.068 | 0.128 |
| **C.D.(P=0.05)** | | 0.340 | 0.362 | 0.193 | 0.362 |

## QUALITY CHARACTERS

### Fresh weight of green pod

The analyzed data presented in table evidenced that foliar fertilization of nano urea proved significant on fresh weight of green pod, among different of nano urea (20 g urea/liter) significantly enhanced the fresh weight of pod at each picking stage. The other levels of treatments were also recorded sign cant increase of pod weight at each picking stage over to control. Only $T_1$, T4 treatments remained non-significant. The data summarized on pod yield is envisaged that fresh weight of green pod at 1" picking under all treatment gradually noted higher than the 2nd and 3rd picking. Similarly pod weight at $2^{nd}$ picking under all treatments was also noted higher than the weight of 3rd picking.

The tables demonstrate that fresh weight of pod gradually declined with advance age picking. The mean value of green pod weight was recorded maximum (9.18g) with foliar application of $T_4$ (20g urea/ Litre) followed by 9.60 under $T_4$ level. The minimum pod weight was noted under $T_1$, followed by control.

**Table - 3 : Fresh weight of green pod.**

| Treatments | | At 1st picking | At 2nd Picking | At 3rd Picking | Mean |
|---|---|---|---|---|---|
| T1 | 100% RDF (40:60:30 NPK kg/ha-1) | 9.01 | 8.71 | 8.41 | 8.71 |
| T2 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 9.18 | 8.91 | 8.58 | 8.89 |
| T3 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 9.05 | 8.78 | 8.45 | 8.76 |
| T4 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 9.45 | 9.18 | 8.85 | 9.16 |
| T5 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 9.38 | 9.11 | 8.78 | 9.09 |
| T6 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 9.38 | 9.11 | 8.78 | 9.09 |
| T7 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing | 9.51 | 9.24 | 8.91 | 9.22 |
| T8 | 0.4% nano urea foliar spray at 30 days after sowing | 9.85 | 9.58 | 9.25 | 9.56 |
| **F- test** | | S | S | S | S |
| **S.Ed.(±)** | | 0.094 | 0.132 | 0.174 | 0.174 |
| **SE(m)** | | 0.067 | 0.094 | 0.123 | 0.123 |
| **C.D.(P=0.05)** | | 0.189 | 0.265 | 0.348 | 0.348 |

**Number of green grains per pod**

It is evident from table that foliar application of nano urea significantly affected the number of green grains per pod. The number of green grains per pod increased with increasing nitrogen levels up to 20g/litre. On an average the grain number per pod was noted maximum in the plots treated with $T_3$ (0.4% nano urea) at each picking stages. $T_4$, $T_6$, and No treatments also recorded significant grain number at each picking. The non-significant result regarding number of green grain noted under treatments of $T_3$, and $T_4$. It is quite obvious from table 1 picking exhibit superiority over 2nd and 3rd picking regarding number of green grain per pod. Similar effect also posited in 2nd picking as compared to 3rd picking by obtaining greater green grains per pod. The mean value also workout and present in table. The table showed that highest number of green grains pod (8.77) was noted under $T_8$ level (0.4% nano urea) followed by grains 8.43 as under $T_7$ levels. Over all higher number of green grains recorded under each treatment at each picking comparison to control.

**Fresh weight of green grains per pod**

A Perusal tables 9 revealed that foliar feeding of nano urea significantly affect the weight of green grains per pod. Among all treatments T8 level of nano urea significantly recorded maximum fresh weight (4.43g) of green grain followed by 4.09g under treatment T7 as compared to control. Remaining all treatments T1, T2, T4 and did not show any significant effect on fresh weight of green grains. The minimum grain weight (3.84g) received under T1 followed by control (3.35g). It is clear from

**Table - 4 : Number of green grains per pod**

| Treatments | | At 1st picking | At 2nd Picking | At 3rd Picking | Mean |
|---|---|---|---|---|---|
| T1 | 100% RDF (40:60:30 NPK kg/ha-1) | 8.05 | 7.92 | 7.79 | 7.92 |
| T2 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.22 | 8.12 | 7.96 | 8.10 |
| T3 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.09 | 7.99 | 7.83 | 7.97 |
| T4 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.49 | 8.39 | 8.23 | 8.37 |
| T5 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.42 | 8.32 | 8.16 | 8.30 |
| T6 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.42 | 8.32 | 8.16 | 8.30 |
| T7 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing | 8.55 | 8.45 | 8.29 | 8.43 |
| T8 | 0.4% nano urea foliar spray at 30days after sowing | 8.89 | 8.79 | 8.63 | 8.77 |
| **F- test** | | S | S | S | S |
| **S.Ed.(±)** | | 0.057 | 0.081 | 0.157 | 0.195 |
| **SE(m)** | | 0.040 | 0.057 | 0.111 | 0.138 |
| **C.D.(P=0.05)** | | 0.113 | 0.163 | 0.314 | 0.389 |

table that fresh weight green grain received higher is 1 picking than the weight of 2nd and 3rd picking under all treatments even in control also. Similarly 2nd picking also obtained higher grain weight in comparison to 3rd picking under each treatment with control. The table reveals that the fresh weight of green grains gradually decreased with successive picking. It is also clear from table that minimum (1% urea) and maximum (0.4% urea) levels of nitrogen fertilization showed antagonistic effect on fresh weight of green grains per pod.

**Table - 5 : Fresh weight of green grains per pod**

| Treatments | | At1stpicking | At 2nd Picking | At 3rd Picking | Mean |
|---|---|---|---|---|---|
| T1 | 100% RDF (40:60:30 NPK kg/ha-1) | 3.51 | 3.32 | 3.23 | 3.35 |
| T2 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 3.41 | 3.25 | 3.13 | 3.26 |
| T3 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 3.78 | 3.62 | 3.50 | 3.63 |
| T4 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 4.18 | 4.02 | 3.90 | 4.03 |
| T5 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 4.16 | 4.00 | 3.88 | 4.01 |
| T6 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 4.11 | 3.95 | 3.83 | 3.96 |
| T7 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing | 4.24 | 4.08 | 3.96 | 4.09 |
| T8 | 0.4% nano urea foliar spray at 30 days after sowing | 4.58 | 4.42 | 4.30 | 4.43 |
| **F- test** | | S | S | S | S |
| **S.Ed.(±)** | | 0.006 | 0.015 | 0.025 | 0.028 |
| **SE(m)** | | 0.004 | 0.011 | 0.017 | 0.020 |
| **C.D.(P=0.05)** | | 0.011 | 0.031 | 0.049 | 0.057 |

### Shelling percentage

It is clear from table that non-significant results were obtained under all treatments of nano urea. The maximum shelling percentage (47.56) was recorded followed by 47.47 when 0.4% urea applied at flowering stage as foliar feeding under T1 and T2 levels of nitrogen respectively. Non- significant lowest shelling percentage was noted under highest levels of nitrogen i.e. T4 and T5 with 47.15 and 47.28% respectively. The result of this investigation showed that shelling percentage gradually decreased with increased level of nitrogen fertilization. This trend maybe due to greater assimilation of nitrogen in pod shells resulting higher growth and higher weight may lead higher shelling percentage under higher nano urea feed pods.

**Table - 6 : Shelling Percentage**

| Treatments | | Pod weight (g) | Weight of grains (g) | Shelling percentage |
|---|---|---|---|---|
| T1 | 100% RDF (40:60:30 NPK kg/ha-1) | 7.74 | 3.86 | 47.56 |
| T2 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.55 | 4.18 | 47.47 |
| T3 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.48 | 4.11 | 47.08 |
| T4 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.34 | 3.97 | 47.15 |
| T5 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.68 | 4.31 | 47.28 |
| T6 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 8.59 | 4.22 | 44.94 |
| T7 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing | 8.87 | 4.50 | 43.86 |
| T8 | 0.4% nano urea foliar spray at 30 days after sowing | 8.96 | 4.59 | 47.19 |
| **F- test** | | S | S | S |
| **S.Ed.(±)** | | 0.104 | 0.100 | 0.688 |
| **SE(m)** | | 0.074 | 0.071 | 0.486 |
| **C.D.(P=0.05)** | | 0.208 | 0.201 | 1.376 |

## YIELD CHARACTERS

### Yield of pods per plot (g)

That data presented in the table reveal that T2 nano urea fertilization obtained maximum yield (3342.24) of green pods followed by T4 level (3424.03g) while T1, level noted minimum yield (3339.95g) of green pods per bed. The yield of green pods i.e. 3342.24g, 3424.03g, 3339.95g were noted significantly at par in comparison the control (T1, 3339.95g) under treatments of T2, T3, and T5 and T6 respectively. Whereas T1, and T4 levels of nitrogen did not show any significant yield in comparison to control.

### Yields of green pods per hectare (q)

The analyzed data in table showed that nano urea as foliar feeding on pea plants have significant effect on pod yield. It is obvious from table that maximum yield (130.47 q/ha) of green pod was obtained when plant sprayed with nano urea @20g urea/litre T7 level just followed T8 getting yield (126.56 q/ha) of green pod other level of nitrogen i.e. T2 and T1 obtained yield of pod 116.15 and 115.86 q/ha respectively record at par to T2 and T1 as compared to control. T7 significant yield noted under treatment of T1 and T8.

**Table - 7 : Yield of Pod**

| | Treatments | Yield per ha | Weight of pod per plant | No. of plants per bed | Yield of pod per bed |
|---|---|---|---|---|---|
| T1 | 100% RDF (40:60:30 NPK kg/ha-1) | 115.86 | 62.71 | 54.00 | 3339.95 |
| T2 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 116.15 | 65.03 | 55.00 | 3342.24 |
| T3 | 25% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 116.08 | 64.96 | 53.00 | 3384.17 |
| T4 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 125.94 | 74.82 | 53.00 | 3424.03 |
| T5 | 50% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 126.28 | 75.16 | 52.00 | 3427.37 |
| T6 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 30 and 60 days after sowing | 127.19 | 76.07 | 52.00 | 3448.28 |
| T7 | 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing | 130.47 | 79.35 | 52.00 | 3461.56 |
| T8 | 0.4% nano urea foliar spray at 30 days after sowing | 126.56 | 75.44 | 52.00 | 3427.65 |
| **F- test** | | S | S | NS | S |
| **S.Ed.(±)** | | 1.595 | 0.480 | 0.969 | 7.304 |
| **SE(m)** | | 1.128 | 0.339 | 0.685 | 5.165 |
| **C.D.(P=0.05)** | | 3.190 | 0.960 | 1.939 | 14.610 |

## CONCLUSION

The results of this experiment reveal that vegetable pea responds will to foliar feeding of nano urea. The yield of per pods can be maximized with the application of 75% RDF of N through prilled urea +0.4% nano urea foliar spray at 60 days after sowing nano urea. This conclusive result was obtained when nano urea was given as foliar feeding at flowering stage of vegetable pea crop.

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