Effect of Nano DAP on growth and yield performance of *Triticum aestivum*(L.) east nimar region,Khandwa, MP.

ABSTRACT

The utilization of nanotechnology in the form of nano-fertilizer offers a sophisticated, effective, and environmentally-conscious solution to traditional synthetic fertilizers. With the ability to slowly and consistently release nutrients, these nano-fertilizers not only promote plant growth but also protect the valuable diversity of beneficial microorganisms in the soil. An elegant and persuasive field experiment was carried out during the Rabi season of 2023-24 at the School of Agriculture, Research farm of DR. C.V. Raman University in Khandwa, Madhya Pradesh. The focus of the study was on evaluating the impact of Nano DAP on the growth and productivity of wheat (*Triticum aestivum* L.), specifically the HI-1634 (Pusha Ahilya) variety, through foliar application. The experiment followed a ~~randomized~~ Randomized ~~block~~ Block ~~design~~ Design (RBD) with seven unique treatments, each replicated thrice. Various growth parameters, yield, and Benefit cost ratio content were meticulously recorded and analyzed. The findings revealed that treatment T1 (The treatment must be written) resulted in the highest number of tillers and yield, closely followed by T6 (The treatment must be written), which exhibited significantly higher performance with the application of 100% NPK. The foliar sprays of nano-DAP in T1 treatment showed promising outcomes in terms of tillers, grains per ear head, spiklet per ear head, ear head length, and yield per hectare. The cost of cultivation in T1 treatment was found to be relatively higher but comparable to T6 treatment. It is evident that utilizing Nano DAP in place of up to half of traditional DAP, as well as treating seeds with Nano DAP, leads to superior root growth and overall crop development.

Keywords: Wheat, foliar application, nano-DAP, yield

Introduction

Wheat (*Triticum aestivum* L.) is a cereal grain that originated in the Levant region but is now grown all over the world (Feldman *et al.*, 2007). Wheat is a grain crop that provides a significant amount of carbohydrate (Shewry and Hey, 2015). It is the most common source of

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vegetable protein in human meals, with a protein level of around 13%, which is reasonably high when compared to other main cereals but low in protein quality for delivering important amino acids. Wheat is grown on 223.40 million hectares, yielding 778.6 million metric ~~tonnes~~tons globally. It is cultivated on 31.62 million hectares in India, with a total yield of 3420 kg per hectare and a total production of 109.2 million metric ~~tonnes~~tons (USDA, 2021). Madhya Pradesh produces wheat on 10.02 million hectares, yielding 16.52 million metric ~~tonnes~~tons with a productivity of 3298 kg per hectare (Department of Agriculture, M.P. 2021).

The Indian population was 683 million in 1981, but it is expected to increase to 1475 million by 2030. To feed the predicted 1.48 billion people by 2030, India would need to produce 350 million ~~tonnes~~tons of food grains. This growing trend indicates that the creation and application of new forms of fertilizers is one of the few viable alternatives for feeding the predicted world population of 9.6 billion in 2050 or more without adversely endangering ecosystems and the environment. The recent surge in global population has compelled the agricultural industry to enhance crop yield in order to feed billions of people, particularly in underdeveloped and emerging nations. The use of huge amounts of chemical fertilizers enhanced crop yield while disrupting soil mineral balance and decreasing soil fertility (Jain *et.al.*, 2021).

Materials and methods

Study area

The field experiment on wheat crop was conducted in the research farm of DR. C.V. Raman University Khandwa M.P. The study location comes under tropical and subtropical climate zone and is located at 21°50'N, latitude and 76°13'E longitude and the maximum and minimum height above mean sea level is 905.56 m and 180.00 m respectively.

Experimental details:

I was used 7 Treatments with 3 Replication of Wheat variety- (HI-1634) with Fertilizer dose (RDF) N: P_2O_5: K2O:~~:~~ 120:60:40 and Statistical design Randomized Block Design (RBD). Plant spacing ~~were~~was used 22.5 cm (Row to Row), Seed rate of wheat seeds were used 100 $kgha^{-1}$, Gross plot Size was used 5 m × 5 m and Net Plot Size was 4 m × 4.10 m (the refrance?)

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Details of treatments:

I was used 7 treatment which is **(T1)**-100% NPK (120:60:40 kg ha^{-1} Recommended dose), **(T2)**-75% N & P and 100% K (90:45:40 kg ha^{-1}), **(T3)**- 50% N & P and 100% K (60:30:40 kg ha^{-1}), **(T4)**- T2 + ST with Nano DAP @ 5 ml/kg seed + FS with Nano DAP @ 2 ml/litter of water at 30 DAG , **(T5)**-T3 + ST with Nano DAP @ 5 ml/kg seed + FS with Nano DAP @ 4 ml/liter of water at 30 DAG, **(T6)**- T2 + ST with Nano DAP @ 5 ml/kg seed + FS with Nano DAP @ 4 ml/litter of water at 30 DAG and **(T7)**- Absolute Control

NOTE: - ST - Seed treatment FS – Foliar spray DAG – Days after germinationDAP-What do you mean?

Observation to be recorded on wheat crop

Growth parameters: ~~under~~ Under the growth parameters ~~I~~ i was recorded ~~Plant~~ plant population 20 DAS and at harvest, Plant height (cm) at 30,60,90 DAS and at harvest, Fresh weight at 30,60,90 DAS (What do you mean?)and at harvest, Dry weight at 30,60,90 DAS and at harvest., No. of tillers at 30,60,90 DAS and at harvest andPost-Harvest parameters were recorded**,** ~~Effective~~ effective tillers (m^{-1}), No. of ~~Grains~~ grains ~~Earhead~~earhead-1, ~~Test~~ test weight (g), ~~Biological~~ biological yield (kg ha^{-1}), ~~Grain~~ grain yield (kg ha^{-1}), ~~Straw~~ straw yield (kg ha^{-1}), ~~Harvest~~ harvest index (%).

Results and Discussion

Growth performance data were recorded among treatments as given below:

Plant Height and Plant Population: Plant height differed significantly (p = 0.05) among the various treatments. After 30 days of growth, Plant height ranged from 20.33 cm to 22.67 cm with an average value of 21.57 cm. The maximum plant height (22.67 cm) was recorded in the T1 which is 100% NPK (120:60:40 kg ha^{-1} Recommended dose)followed by T6 (22.33 cm) and minimum (20.33 cm) was noticed in T7 which is absolute control followed by T4 (22.00 cm) and

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T3 (20.67 cm). The variation in Plant height in different treatments can be attributed to its peculiarity to increase height of plant by cell enlargement and the influence of environment during the period of growthPlant population data were recorded non- significantly (p = 0.05) among the various treatments. Plant population data was recorded after 20 days. Highest plant population was recorded T1 treatment 38.93 cm which is closely followed by T6 98.92cm and lowest was recorded T7 37.40 cm Plant height maximum recorded after 60DAS, 90DAS, at the time of harvest which was 57.00 ~~cm~~, 84.00 ~~cm~~, and 83.80 cm respectively which was followed by 55.67 ~~cm~~, 81.67 ~~cm~~ and 81.17cm. Plant height minimum recorded after 60 days, 90 days, and at the time of harvest which was 44.33~~cm~~ 64.33 ~~cm~~ and 63.83 cm. it shown on Fig. 1.~~plants~~Plants were able to avail the most of their available growth resources, resulting in increased plant height owing tothe weed-free environment. Similar results were reported by Poudel*et.al.*, (2023).

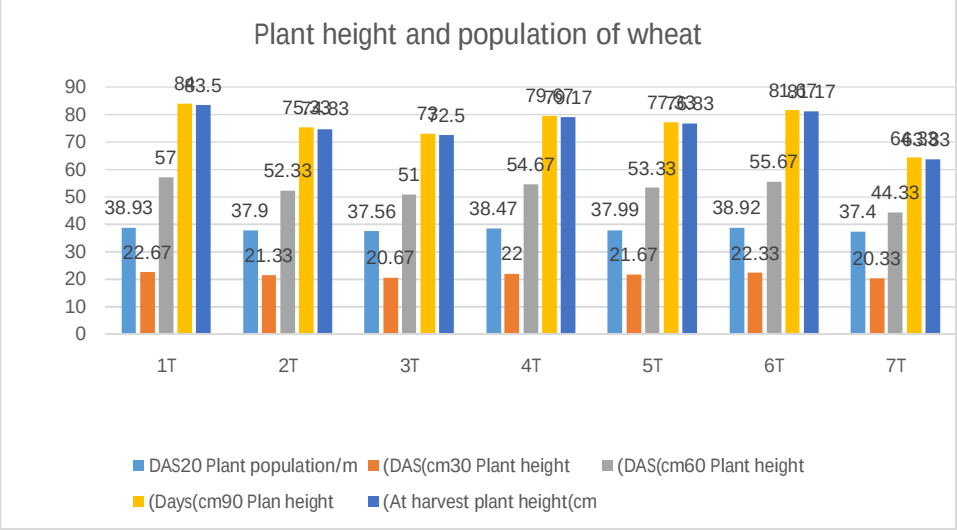

Fig. 1. Plant height and population of wheat

Fresh weight and Dry Weight:in Fig. 2 ShowFresh weight differed significantly (p = 0.05) variation in among the various treatments. After 30 days, 60 days, 90 days of growth, fresh weight ranged after 30 days that is 117.75 ~~g~~to 124.46 g with an average value of 120.96g. The maximum fresh weight is recorded after 30 ~~days~~, 60 ~~days~~ and 90 days, T1 treatment recorded highest fresh weight is 124.46 ~~g~~, 364.48 ~~g~~ and 409.28 g followed by T6 treatment which is

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123.83 g, 362.66 g, 406.55 g respectively. Lowest fresh weight recorded after 30 days, 60 days and 90 days which is T7 117.75 g, 198.40 g and 199.07 g.Dry weight differed significantly (p = 0.05) variation in among the various treatments. After 30 days, 60 days, 90 days of growth, dry weight ranged after 30 days that is 29.44 g to 31.44 g with an average value of 30.24 g. The maximum dry weight is recorded after 30 days, 60 days and 90 days, T1 treatment recorded highest dry weight is 31.11 g, 127.57 g and 245.57 g followed by T6 treatment which is 30.96 g, 126.93 g, 243.93 g respectively. Lowest dry weight recorded after 30 days, 60 days and 90 days which is T7 29.44 g, 69.44 g and 119.44 g.Our study results is are well in line with the findings ofKumari*et.al.*, (2017)

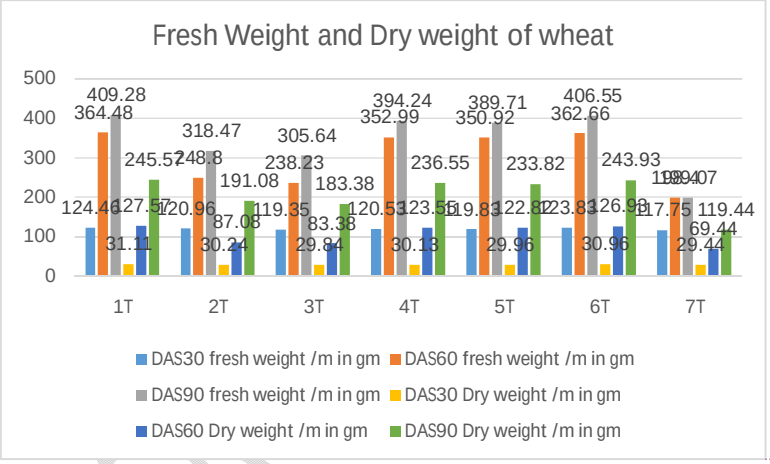

Fig. 2. Fresh Weight and Dry weight of wheat

Number of tillers/m: Number of tillers differed significantly (p = 0.05) variation in among the various treatments. After 30 days, 60 days, 90 days of growth, number of tillers ranged after 30 days that is 48.00 tillersto 50.11 tillers with an average value of 48.51 tillers. The maximum tillers is recorded after 30 days, 60 days and 90 days, Fig. 3 show, T1 treatment recorded highest number of tillers that is 50.11 tillers, 75.11 tillersand 75.11 tillers followed by T6 treatment which is 49.03 tillers, 73.13 tillers, 73.13 tillersrespectivelycosecutively. Number of tillers wereNumber of tillers was recorded after 30 days, 60 days and 90 days which is T7 48.00 tillers, 63.00 tillers and 63.00 tillers respectively. Crop growth, leading in the efficient use of growth

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resources, resulting in these treatments having the higher number of tillers. These results were confirmed byRajput *et.al.*,(2022) and Malothe*t.al.*, (2024)

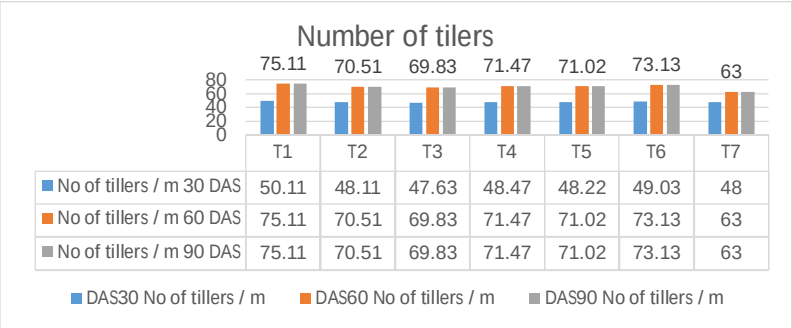

Fig.3. Number of tillers

Grain per ear head:In the fig.4, Grain per ear head recordeddiffered significantly (p = 0.05) variation in among the various treatments, grain per ear head highest recorded T1 38.20 followed by T6 35.20 and lowest was recorded 31.60 which is followed by T3 32.60. Grain per ear head ranged between 31.60 to 38.20 and average of among treatments is recorded 34.31.Spikelet per ear head recordeddiffered significantly (p = 0.05) variation in among the various treatments, Spikelet per ear head highest recorded T1 12.73 followed by T6 11.73 and lowest was recorded 10.53 which is followed by 10.87 Spikelet per ear head ranged between 10.53 to 12.73 and average of among treatments is recorded 11.43. Ear head length was recorded significantly (p = 0.05) variation in among the various treatments, ear head length highest recorded T1 8.95 cmclosely followed by T6 8.90 cm and lowest was recorded T7 7.45 cm. Ear head length ranged between 7.45cm to 8.95cm and average of among treatments is recorded 8.45cm.Our study is well in line with the findings ofMahachandramuki*et.al.*, (2023)

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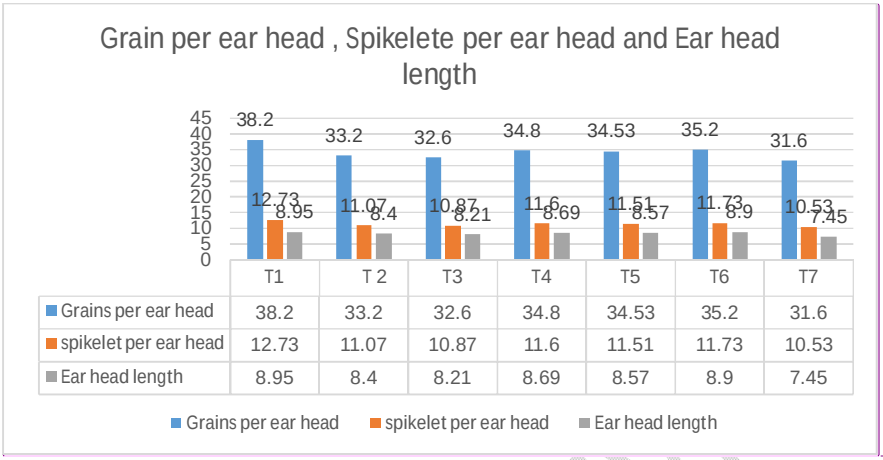

Fig.4. Grain per ear head, Spikelete per ear head and Ear head length

Test weight: Test weight and net plot yield was recorded significantly (p = 0.05) variation in among the various treatments, Test weight was highest recorded T1 93.60 gm closely followed by T6 39.42 gm and lowest was recorded T7 35.42 gm. Test weight ranged between 35.42 gm to 39.60 gm and average of among treatments is recorded 37.85 gm. Net plot yield was highest recorded T1 6.93 kg closely followed by ~~T6 6.83~~T6 6.83 kg and lowest was recorded T7 3.25 kg. Net plot yield ranged between 3.25 kg to 6.93 kg and average of among treatments was recorded 5.77 kg. it was show on Fig. 5. Similar findings were also reported by Kumar, ~~*Y. et.al*~~*et al.* (2021)

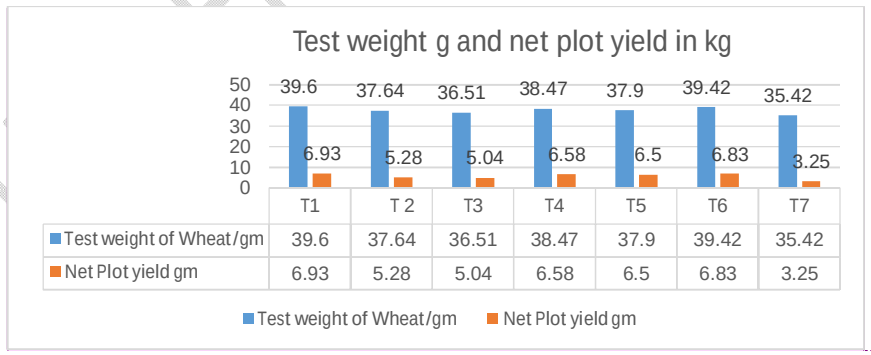

Fig.5. Test weight (g) and net plot yield in (kg)

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Yield and straw yield:

In the Fig. 6., Yield and straw yield was recorded significantly (p = 0.05) variation in among the various treatments, Yield of wheat was highest recorded in T1 4226.33kg ha^{-1}which was closely followed by T6 4164.67 kg $ha^{-1}$and lowest was recorded in control T7 1984.33 kg ha^{-1}. Yield of wheat ranged between 1984.33kg $ha^{-1}$to 4226.33 kg $ha^{-1}$and average of among treatments was recorded 3520.94 kg ha^{-1}. Straw yield of wheat was highest recorded T1 6339.5 kg ha^{-1}closely followed by T6 6330.25kg $ha^{-1}$and lowest was recorded T7 3174kg ha^{-1}.Growth parameters and yield attributing features were achieved, resulting in better grain and straw yield among all treatments. Similar findings were also reported by Singh*et.al.*~~,~~ (2023)

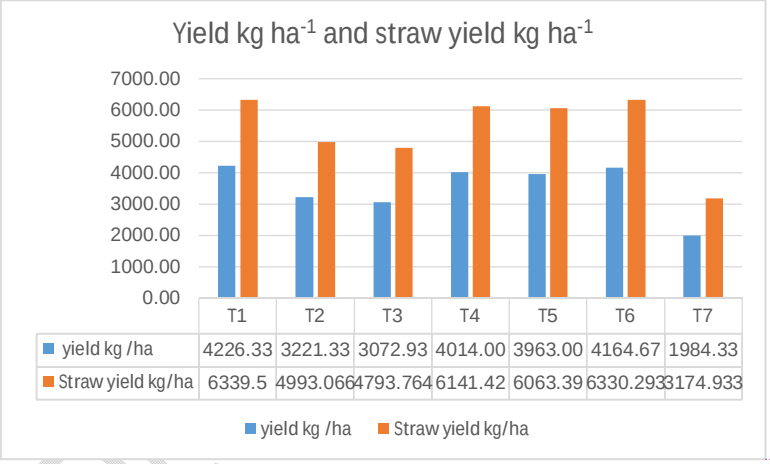

Fig.6. Yield kg ha^{-1} and straw yield kg ha^{-1}

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Harvest index (%): Harvest index was recorded significantly (p = 0.05) variation in among the various treatments, Fig. 7. Show Harvest index of wheat was highest recorded in T1 40.03 % which was closely followed by T6 39.69 % and lowest was recorded in control T7 37.89 %. average of Harvest index was recorded 39.28 %.~~higher~~Higher value of harvest index T1 (40.03 %) because of higher amount of photosynthate assimilation as compared to other the treatments. Similar findings were also reported by Kumar *et.al.(*2011) and Jaidev*et al.* (2012).

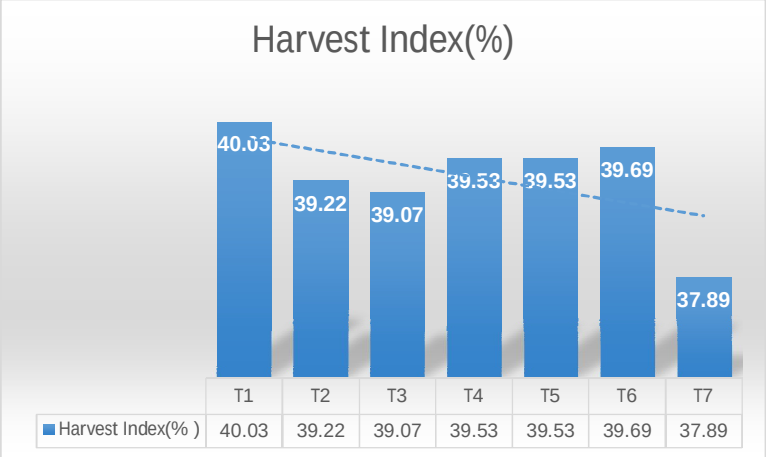

Fig.7. Harvest Index (%)

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Conclusion

Based on experimental results, with respect to growth parameters, yield attributing characters and grain yield, it can be concluded that wheat varietyHI-1634 (Pusha Ahilya) the result of the experiment show that the RDF treatment (T1) is better as compared to rest of the treatments such like Growth parameters, yield attributes and yield but, in prospect of economically the treatment T5 (T3 + ST with Nano DAP @ 5 ml/kg seed + FS with Nano DAP @ 4 ml/liter of water at 30 DAG) is best for farmers because in this treatment can save 50% N and P cost in rupees.

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