Original Research Article

Impact of Plant Growth Regulators and Organic Manures on ~~growth and yield Traits~~ of Black gram (*Vigna mungo* L.)

ABSTARCT

A field experiment was conducted during *kahrif* 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The experiment was laid out in Randomized Block Design with nine treatments ~~each replicated thrice on the basis of one year experimentation~~. The treatments ~~which are~~ T_1: Gibberellic acid at40 ppm + FYM at2.5 t/ha, T_2: Gibberellic acid at40 ppm + Vermicompost at1.6 t/ha, T_3: Gibberellic acid at40 ppm + Poultry manure(PM) at0.6 t/ha, T_4: Indole acetic acid at500 ppm + FYM at2.5 t/ha, T_5: Indole acetic acid at500 ppm + Vermicompost at1.6 t/ha, T_6: Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha, T_7: Salicylic Acid at150 ppm + FYM at2.5 t/ha, T_8: Salicylic Acid at150 ppm + Vermicompost at1.6 t/ha, T_9: Salicylic Acid at150 ppm + Poultry manure (PM) at 0.6 t/ha are used. The results showed that application of Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha was recorded significantly higher plant height (45.24 cm), nodules/Plant (15.00), No. of Branches/plant (6.39), Plant dry weight (6.39 g/plant), Pods/plant (65.37), Seeds/pod (7.73), Test weight (36.56 g), Seed yield (1227.63 kg/ha), Haulm yield (2421.79 kg/ha) and Harvest index (33.62 %) as compared to other treatments.

Key words: Gibberillic acid, FYM, Indole acetic acid, Poultry manure, Salicylic acid, Vermicompost, yield.

INTRODUCTION

One of the most important pulse crops is blackgram (Vigna Mungo). In all tropical and subtropical countries, dietary legumes, particularly grain or pulses, are major food sources **(Palanichamy *et al*., 2011)**.

It is well-known for its nutritional value, which includes high levels of protein (22-24%), carbs (56.6-59.6%), fat (1.2-1.4%), minerals (3.2%), phosphorus (385 mg/100g), and calcium and iron. It differs from other pulses in that it has a relatively mucilaginous pasty texture, which gives the bulk more body due to the lengthy polymer chain of polysaccharide chains of carbohydrates. It is referred to as "poor man's meat" due to the lower cost of the

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protein source **(Aslam *et al.*, 2010)**.

Plant growth regulators such as salicylic acid (SA) and gibberellic acid (GA3) are well-known endogenous regulators of plant metabolism that play a role in both biotic and abiotic stress **(Aydin and Nalbantoglu, 2011)**. Gibberellins are a tetracyclic diterpenoid family of plant growth chemicals. Salicylic acid, also known as ortho-hydroxybenzoic acid, is a secondary metabolite that functions similarly to growth regulators. When administered at physiological concentrations, foliar application of salicylic acid had a considerable effect on plant growth metabolism, and hence operated as one of the plant growth regulating chemicals **(Kalarani, *et al.*, 2002)**.Under diverse salinity conditions, foliar application of SA and GA3 at varied doses had positive effects related to salinity stress reduction but low concentration **(M. I. Hossain, *et al.*)**.

Vermicomposting (VC) is a simple and effective technology for reprocessing agricultural waste, municipal waste, and kitchen waste, as well as bioconversion of organic waste materials into nutritional compost, using earthworms. The bio-conversion of organic waste into vermicasts and vermiwash using earthworms is part of the VC technology **(Jadia & Fulekar, 2008)**. Through its good effects on soil physical, volatility, and biological qualities, as well as plant nutrition, farmyard manure is known to play a significant role in boosting soil fertility and capacity. Poultry manure can be utilised effectively for crops once it has been composted to save nutrients. **(Amanullah *et al.*,(2003)**. Poultry manure-collecting plants grew higher than other plants, indicating that more concentrated nutrients or minerals were made readily available and easily absorbable**.(Enujeke, 2013)**.

Comment [h8]: Write importance/facts of organic manures in general instead of individual

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Materials and Methods

The current study was conducted during the kharif of 2021 at the Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, UP, which is situated at 25.28oN latitude, 81.54oE longitude, and 98 m above mean sea level. Yellow mustard is sown with this super goldy type. The experiment was set up in a Randomized Block Design with nine treatments. T_1: Gibberellic acid at40 ppm + FYM at2.5 t/ha, T_2: Gibberellic acid at40 ppm + Vermicompost at1.6 t/ha, T_3: Gibberellic acid at40 ppm + Poultry manure(PM) at0.6 t/ha, T_4: Indole acetic acid at500 ppm + FYM at2.5 t/ha, T_5: Indole acetic acid at500 ppm + Vermicompost at1.6 t/ha, T_6: Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha, T_7: Salicylic Acid at150 ppm + FYM at2.5 t/ha, T_8: Salicylic Acid at150 ppm +

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Vermicompost at1.6 t/ha, T_9: Salicylic Acid at150 ppm + Poultry manure (PM) at 0.6 t/ha were replicated thrice.

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The experimental location had a consistent topography and sandy loam texture, had a virtually neutral soil response (PH 7.1), was low in organic carbon (0.38 percent), had medium available N (225 kg ha-1), greater available P (19.50 kg ha-1), and medium available K. (213.7 kg ha-1).The foliar spray of different Plant growth regulators (Gibberellic acid, Indole acetic acid and Salicylic Acid) was done according to the treatment details. Organic manures were applied before sowing in respective plot as per the treatment details. Several plant growth metrics were recorded at numerous intervals from germination through harvest, as well as several yield parameters after harvest. These parameters include growth factors such as plant height (cm), Plant dry weight (g), nodules/Plant, and No. of Branches/plant. Pods/plant, Seeds/pod, Test weight (g), Seed yield (kg/ha), Haulm yield (kg/ha), and Harvest index were recorded and statistically evaluated using analysis of variance (ANOVA) as applied to Randomized Block Design (Gomez K.A. and Gomez A.A. 1984).

Results and Discussion

Growth attributes

Plant height :

Data in table 1 tabulated that significantly highest plant height (45.24 cm) was observed in the treatment with Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha over all the other treatments. However, the treatments with application of Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha (44.75 cm) and Salicylic Acid at150 ppm + Poultry manure (PM) at 0.6 t/ha (44.29 cm) which were found to be statistically at par with treatment Indole acetic acid at500 ppm + Poultry manure at 0.6 t/ha Indole Acetic acid has a regulatory function in that it produces the shoot apex primary in the leaf primodial and root system, which stimulates stem development as well as cell division, cell elongation, and enzyme release, resulting in an increase in plant height. **Quaderi *et al.* (2006).** Poultry manure application may have favoured improved root proliferation, higher phosphorus solubility, and hence higher biological nitrogen fixation, nutrient uptake, and availability of all plant nutrients during the crop growth period. As a result, the plant's height increased. These findings are very similar to **Patil's findings (2000).**

Comment [h15]: These findings are very similar to findings of Patil (2000).

Plant dry weight (g/plant):

Treatment with Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha was recorded with significantly maximum dry weight (6.39 g/plant) over all the treatments. However, the treatments with Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha (6.28 g/plant) and Salicylic Acid at150 ppm + Poultry manure (PM) at 0.6 t/ha (6.25 g/plant) which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha.

Due to their own metabolism regulation, IAA increases cell proliferation in plant developmental phases and promotes cell development by increasing turgor pressure. It also activates different enzymes and has a good influence on plant growth and dry matter accumulation. According to **Quaderi *et al*.,** the results were discovered (2006). The increase in total dry matter production could be due to improved source and sink capacity developed as a result of improved dry matter production and accumulation in assimilatory surface area, as well as an increase in photosynthetic efficiency, which resulted in increased production of photosynthates, which in turn resulted in better growth and, ultimately, higher dry accumulation. The findings were found to be comparable to those of **Nehra *et al* (2001).**

Comment [h16]: Mention the year of study just after name of scientist(s).

Nodules/Plant:

Significantly highest nodules per plant (15.00) was observed in the treatment with application of Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha, which was significantly higher over rest of the treatments. However, the treatments with Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha (14.58) and Salicylic Acid at150 ppm + Poultry manure (PM) at 0.6 t/ha (14.23) which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha. The increase in number of nodules per plant might be due to direct addition and slow release of nutrients from poultry manure. The more content of phosphorous and its solubility in soil helped in better root proliferation and formation of nodules. The results were found to be in resonance with **Pandey *et al.* (2019**).

Branches/Plant:

Significantly highest number of Branches per plant (6.39) was observed in the treatment with application of Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha, which was significantly higher over rest of the treatments. However, the treatments with Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha (6.30) and Salicylic Acid at150 ppm + Poultry manure (PM) at 0.6 t/ha (6.28) which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha. The increased number of

branches due to the application of poultry manure could be related to the availability of desired and required quantities of nutrients in the root zone of growing plants for a longer length of time, allowing plant cells to divide. The outcomes were found to be in line with ~~**Patil's expectations (2000).**~~

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Table 1 Impact of Plant growth regulators and Organic Manures on Plant height (cm) of Black gram.

Treatments	Plant height (cm)	Dry weight (g)	Nodules/plant	Branches/plant
1. Gibberellic acid at40 ppm + FYM at2.5 t/ha	40.61	5.56	11.77	5.76
2. Gibberellic acid at40 ppm + Vermicompost at1.6 t/ha	43.22	5.95	13.27	5.96
3. Gibberellic acid at40 ppm + Poultry manure(PM) at0.6 t/ha	44.75	6.28	14.58	6.30
4. Indole acetic acid at500 ppm + FYM at2.5 t/ha	41.72	5.68	12.42	5.83
5. Indole acetic acid at500 ppm + Vermicompost at1.6 t/ha	43.88	6.07	13.81	6.12
6. Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha	45.24	6.39	15.00	6.39
7. Salicylic Acid at150 ppm + FYM at2.5 t/ha	39.95	5.34	11.11	5.70
8. Salicylic Acid at150 ppm + Vermicompost at1.6 t/ha	42.31	5.95	12.91	5.88
9. Salicylic Acid at150 ppm + Poultry manure(PM) at0.6 t/ha	44.29	6.25	14.23	6.28
S. EM (±)	0.35	0.06	0.25	0.05
CD (P = 0.05)	1.04	0.20	0.77	0.14

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Yield attributes and Yield

Significantly Maximum Pods/plant (65.37) was recorded with the treatment of application of Indole acetic acid at 500 ppm + Poultry manure (PM) at 0.6 t/ha over all the treatments. However, the treatments Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha (64.57) which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha. Significantly highest Seeds/Pod (7.73) was recorded with the treatment of application of Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha over all the treatments. However, the treatments Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha (7.59) and Salicylic Acid at 150 ppm + Poultry manure (PM) at 0.6 t/ha (7.49) which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha. The beneficial response of poultry manure to yield attributes could be attributed to the availability of sufficient amounts of easily utilisable plant nutrients throughout the growth period, particularly during critical growth periods of the crop, resulting in improved uptake, plant vigour, and superior yield attributes. The results are in conformity with **Singh *et al.* (2017).** Highest Test weight (36.56 g) was recorded with the treatment application of Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha over all the treatments. However, the treatments with (35.64 g) in Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha.

Significantly highest Seed yield (1227.63 kg/ha) was recorded with ~~the treatment~~ application of Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha over all the treatments. However, the treatments with (1168.37 kg/ha) in Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha. IAA is important for improving seed yield because it is involved in a variety of physiological processes in plants, including chlorophyll synthesis, stomatal control, and starch consumption, all of which improve seed yield. The results were in accordance to **Hanaa and Safa (2019).** Significantly highest Haulm yield (2421.79 kg/ha) was recorded with the treatment application of Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha over all the treatments. However, the treatments with (2322.20 kg/ha) in Gibberellic acid at40 ppm + Poultry manure (PM) at 0.6 t/ha which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha. The release of macro and micro nutrients during microbial decomposition has been linked to a larger rise in yield. Organic matter also serves as a source of energy for soil microflora, which helps to change other nutrients contained in the soil or applied in other

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ways into a form that is easily consumed by growing plants, resulting in an increase in seed output. The results were in accordance with **Kannan *et al.* (2014).** Significantly highest harvest index (33.62 %) was recorded with the treatment application of Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha over all the treatments. However, the treatments with (33.55 %) ~~in~~ Gibberellic acid at40 ppm + Poultry manure(PM) at0.6 t/ha (32.23 %), ~~in~~ Indole acetic acid at500 ppm + Vermicompost at1.6 t/ha and (320.9 %) which were found to be statistically at par with Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha.

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Treatments	Pods/Plant	Seeds/pod	Test weight (g)	Seed Yield (kg/ha)	Haulm Yield (kg/ha)	Harvest Index (%)
1. Gibberellic acid at40 ppm + FYM at2.5 t/ha	56.56	6.75	31.91	693.29	1740.23	24.47
2. Gibberellic acid at40 ppm + Vermicompost at1.6 t/ha	61.48	7.19	33.16	921.01	2011.39	31.40
3. Gibberellic acid at40 ppm + Poultry manure(PM) at0.6 t/ha	64.57	7.59	35.64	1168.37	2322.20	33.55
4. Indole acetic acid at500 ppm + FYM at2.5 t/ha	57.72	6.94	32.31	799.71	1811.73	30.63
5. Indole acetic acid at500 ppm + Vermicompost at1.6 t/ha	62.23	7.33	33.73	1009.29	2121.92	32.23
6. Indole acetic acid at500 ppm + Poultry manure(PM) at0.6 t/ha	65.37	7.73	36.56	1227.63	2421.79	33.62
7. Salicylic Acid at150 ppm + FYM at2.5 t/ha	54.86	6.57	31.67	615.03	1682.02	26.75
8. Salicylic Acid at150 ppm + Vermicompost at1.6 t/ha	59.66	7.13	32.78	861.38	1873.39	31.49
9. Salicylic Acid at150 ppm + Poultry manure(PM) at0.6 t/ha	63.42	7.49	34.32	1064.49	2253.65	32.09
S. EM±)	0.47	0.09	0.34	30.41	38.02	0.70

CD (P = 0.05)	1.42	0.26	1.03	91.16	114.00	2.09	

Table 2 Impact of Plant growth regulators and Organic Manures on Yield attributes and Yield of Black gram

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CONCLUSION

It is concluded that application of ~~treatment~~ Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha performed exceptionally in obtaining maximum seed yield of Blackgram. Hence, Indole acetic acid at500 ppm + Poultry manure (PM) at 0.6 t/ha is beneficial under eastern Uttar Pradesh Conditions.

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