Original Research Article

"Influence of nitrogen and weed management practices of yield and economics of Blackgram (*Vigna mungo* L.)"

- Abstract: In *Kharif* 2022, a research study was conducted at Crop Research Farm, SHUATS, Prayagraj to investigate "Influence of nitrogen and weed management practices of yield and economics of Blackgram (*Vigna mungo* L.)". The study included three levels of nitrogen (15, 30, and 45 kg/ha) and three weed management practices (hand weeding twice at 20 and 40 DAS, Pendimethalin pre-emergence at 5 DAS, and Imazethapyr post-emergence at 25 DAS). The experiment was designed using a randomized block design with 10 treatments, each replicated thrice. The results indicated that the highest grain yield, stover yield, gross returns, net returns, and benefit-cost ratio were observed in treatment 9, which involved the application of 45 kg/ha nitrogen and 75 g/ha Imazethapyr post-emergence.

- **Key words:** *Blackgram, Nitrogen, Pendimethalin, Imazethapyr, yield attributes and economics.*

1. Introduction:

Black gram, also known as Vigna mungo L., is a significant pulse crop in both Bangladesh and India, with approximately 12.55% of all pulse production and 70,000 ha of cultivated area coverage. It is a nutrient-dense legume, containing carbohydrates, protein, calcium, iron, fat, riboflavin, and thiamine. Asaduzzaman *et al*., 2010 [1] However, the productivity of black gram is often constrained by weeds, particularly during the kharif season, leading to yield losses ranging from 27% to 100%. Manual weeding is not always feasible due to continuous rainfall, and the excessive use of herbicides can cause environmental pollution and resistance among weeds. To address this issue, increasing crop density is an alternative strategy to shift the competition towards the crop's favor, especially since black gram occupies 3.25 million hectares of land, with a total annual production of 1.54 million tonnes in India, and is grown in 4.49 lakh ha with a production of 1.57 lakh tonnes in Madhya Pradesh alone. In Gwalior district, black gram is grown in 6.2 thousand ha with a production of 4.8 million tonnes, and a productivity of 421 kg/ha. Singh *et al*., 2010 [2]. The continuous rainfall during the season makes manual weeding infeasible. However, excessive use of herbicides can lead to environmental pollution and may also result in weeds developing resistance to the chemicals. Increasing the crop density appears to be a viable alternative, as it can shift the competition in favour of the crop, thereby reducing the weed population.

Nitrogen fertilization plays a crucial role in enhancing soil fertility and augmenting crop productivity by increasing grain yield and biomass. It also contributes to a substantial increase in soil residual nitrogen, ranging from 18% to 34%. The incorporation of crop

residues alone or in conjunction with nitrogen fertilizer has favourable effects on plant growth, production, and soil physicochemical properties. Nonetheless, using organic materials along with inorganic fertilizers to maximize nutrient accessibility to plants is challenging because organic materials have a complicated and diverse chemical composition.

To achieve high yields in blackgram cultivation, it is essential to remove weeds at the appropriate time using suitable methods. Hand weeding has been suggested as an effective method by Chand *et al.* (2004) [3]. However, Pendimethalin, a pre-emergence herbicide, is commonly used to manage weeds, although it may not be effective against some perennial sedges and broad-leaved weeds, and can cause weeds to switch to having broad leaves with regular usage. Imazethapyr, a post-emergence herbicide, is applied to control late-blooming weeds, but its longer half-life duration can also affect subsequent grain harvests.

Many herbicides are available in the market for effective weed control in soybean and groundnut crops, including imazethapyr. Imazethapyr is currently considered a very effective post-emergence herbicide for controlling broad leaf and some grassy weeds in blackgram. However, its efficacy has not been tested in combination with other herbicides for wide-spectrum weed control in blackgram, as reported by Verma *et al*. (2020).[4].

In rainfed conditions, if weeds have not yet germinated, Pendimethalin may be effective when applied after the first shower. However, the appropriate weed management practice may vary depending on the specific weed species present and the local climatic conditions. Singh *et al.*, 2016 [5]. Keeping in view the above facts, the present experiment was undertaken to find out "Influence of nitrogen and weed management practices of yield and economics of Blackgram (*Vigna mungo* L.)".

2. MATERIALS & METHODS:

A field experiment was conducted during the *kharif* season of 2022 at the CRF of the Agronomy wing in SHUATS, Prayagraj. The location of the experiment was 25^{o} 24' 42" N latitude, 81^{o} 50' 56" E longitude, and 98 m altitude over the mean sea level. The experiment aimed to investigate the effect of nitrogen and weed management practices on the growth and yield of blackgram (*vigna mungo* L.). The experimental design was a Randomized Block design with ten treatments, which were replicated three times. Each online plot for each treatment was 3m×3m in size. The recommended dose of Potash via Muriate of Potash, Nitrogen via Urea, and Phosphorus via DAP were applied in combination. The treatments were T1: Nitrogen (15 kg/ha) + Hand weeding twice (20 & 40 DAS), T2: Nitrogen (15 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence, T3: Nitrogen (15 kg/ha) + Imazethapyr (75 g/ha) Post-emergence, T4: Nitrogen (30 kg/ha) + Hand weeding twice (20 & 40 DAS), T5: Nitrogen (30 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence, T6: Nitrogen (30 kg/ha) + Imazethapyr (75 g/ha) Post-emergence, T7: Nitrogen (45 kg/ha) + Hand weeding twice (20 & 40 DAS), T8: Nitrogen (45 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence, T9: Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) Post-emergence, T10: Control plot (RDF). At harvesting maturity, the blackgram crop was harvested, and plant height (cm) and dry weight accumulation g/plant were recorded for five randomly selected representative plants from each plot of each replication. Seeds were harvested from each

online plot, dried under the sun for three days, winnowed, washed, and the seed yield per hectare was calculated and expressed in kg/hectare. The Stover production from each online plot was measured and expressed in kg/hectare after ten days of drying in the sun. The data was analysed using statistical analysis. The benefit: cost ratio was recalculated after replacing the seed value with stover and including the overall cost of crop cultivation.

List 1: Details of treatment combinations:

Sr.No	Treatment Combination
1.	Nitrogen (15 kg/ha) + Hand weeding twice (20 & 40 DAS)
2.	Nitrogen (15 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence
3.	Nitrogen (15 kg/ha) + Imazethapyr (75 g/ha) Post-emergence
4.	Nitrogen (30 kg/ha) + Hand weeding twice (20 & 40 DAS)
5.	Nitrogen (30 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence
6.	Nitrogen (30 kg/ha) + Imazethapyr (75 g/ha) Post-emergence
7.	Nitrogen (45 kg/ha) + Hand weeding twice (20 & 40 DAS)
8.	Nitrogen (45 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence
9.	Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) Post-emergence
10	Control plot (RDF)

3. RESULTS & DISSCUSIONS

3.1 Yield and Yield Attributes:

3.1.1 Seed yield (kg/ha):

Different combinations of nitrogen & weed management can have a significant effect on seed production. Highest (1223.33 kg/ha) [Table 1] seed yield (kg/ha) was obtained with application of T9 (Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) (Post-emergence). The increase in seed yield due to phosphorus application is attributed to source and sink relationship. It appears that greater translocation of photosynthates from source to sink might have increased seed yield Patel *et al*. 1984 [6]. weed control treatments had pronounced effect on grain yield but could not be comparable to manual weeding twice. Manual weeding once followed by one hoeing and pendimethalin (0.5 kg/ha) one hoeing through five tined hoe reported similar grain yield. Results of Jain *et al*. (1997). [7].

3.1.2 Stover yield (kg/ha):

The stover yield output of the blackgram crop had also been greatly altered by the treatment of nitrogen & weed management. Stover yield (kg/ha) [Table 1] was maximum (2472.67 kg/ha) in the application T9 (Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) (post-emergence). Whereas, T8

(Nitrogen (45 kg/ha) + Pendimethalin (0.75 ml/ha) (Pre-emergence) (1548.33 kg/ha) and T7 (Nitrogen (45 kg/ha) + Hand weeding twice (20 & 40 DAS)) (2392.67 kg/ha) were statistically at par T9. Stover yield of Black gram was significantly influenced Higher grain yield under integrated weed control treatments (herbicide + hand weeding) may be attributed mainly to the better control of weeds during different stages, manual removal of emerging weedsby hand by herbicides and thereby providing better yield attributes. Chhodavadia *et al*. 2013. [8].

3.2. Economics:

3.2.1 Gross return:

Highest (INR 83,109.00/ha) [Table- 2] gross return was obtained with application of T_9 (Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) (post-emergence), while lowest (INR 52772.10/ha) gross return was obtained with application of T_{10} (RDF). maximum gross return was obtained with PE application of pendimethalin + imazethapyr 1000 g/ha supplemented with HW at 30 DAS. However, higher benefit-cost ratio was realized with PE application of pendimethalin + imazethapyr 1000 g/ha. Hand weeding twice at 15 and 30 DAS lag behind compared to PE application of pendimethalin + imazethapyr 1000 g/ha, with respect to net returns and benefit-cost ratio of blackgram cultivation. Reddy *et al*. (2021) [9].

3.2.2 Net return:

Highest (INR 55489.05/ha) [Table- 2] net return was obtained with application of T_9 (Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) (post-emergence), while lowest (INR 26852.15/ha) net return was obtained with application of T_{10} (RDF). maximum net return of (17135 kg/ha) was found with imazethapyr as which was followed by pendimethalin + imazethapyr (pre-mix) 1.0 kg/ha (16,410 and 2.30) treatment, it was concluded that weed free (two hand weeding at 20 and 40 DAS) treatment recorded maximum seed yield followed by pre-mix herbicides *i.e.* imazethapyr and pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha application. The net return was highest in imazethapyr followed by pendimethalin + imazethapyr (pre-mix) at 1.0 kg/ha. Yadav *et al.*, 2015 [10].

3.2.3 Benefit cost ratio:

Highest (2.01) [Table- 2] benefit cost ratio was obtained with application of T_9 (Nitrogen (45 kg/ha) +

Imazethapyr (75 g/ha) (post-emergence), while lowest (1.04) benefit cost ratio was obtained with application of T_{10} (RDF). maximum B:C ratio was obtained with the application of Pre-emergence application of trifluralin at 0.50 kg/ha + one HW resulted in highest net returns and B:C ratio followed by its application as pre-plant + one HW and both these treatments increased the net return and B:C ratio. respectively, over two HW despite statistically similar yields. Lower profit in case of two HW can be ascribed to additional expenditure for manual weeding as compared to application of herbicide along with only one HW (Rs.2600 ha). Sardana *et al*., (2006) [11].

4. CONCLUSION

It is concluded that the treatment T9 with the combination of Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) post-emergence was found significantly more productive. It is also recorded that maximum Benefit cost ratio (2.0) as compared to other treatment combinations.

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Table 1. Influence of Nitrogen and weed management practices on yield of blackgram.

Treatment No	Treatments	seed yield (kg/ha)	Stover yield (kg/ha)
1.	Nitrogen (15 kg/ha) + Hand weeding twice (20 & 40 DAS)	729.33	1616.67
2.	Nitrogen (15 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence	856.67	1718.67
3.	Nitrogen (15 kg/ha) + Imazethapyr (75 g/ha) Post-emergence	851.67	1846.33
4.	Nitrogen (30 kg/ha) + Hand weeding twice (20 & 40 DAS)	962.67	2003.33
5.	Nitrogen (30 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence	1034.33	2124.33
6.	Nitrogen (30 kg/ha) + Imazethapyr (75 g/ha) Post-emergence	1069.67	2217.00
7.	Nitrogen (45 kg/ha) + Hand weeding twice (20 & 40 DAS)	1113.67	2274.33
8.	Nitrogen (45 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence	1163.00	2392.67
9.	Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) Post-emergence	1223.33	2472.67
10.	Control plot (RDF)	630.67	1548.33
	F-test	S	S
	SEm (±)	30.54	58.63
	CD (p=0.05)	90.74	174.21

Treatment No	Treatments	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1.	Nitrogen (15 kg/ha) + Hand weeding twice (20 & 40 DAS)	27169.95	66300.20	39130.25	1.44
2.	Nitrogen (15 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence	27069.95	68436.20	41366.25	1.53
3.	Nitrogen (15 kg/ha) + Imazethapyr (75 g/ha) Post-emergence	27319.95	68949.50	41629.55	1.52
4.	Nitrogen (30 kg/ha) + Hand weeding twice (20 & 40 DAS)	27319.95	70765.00	43445.05	1.59
5.	Nitrogen (30 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence	27219.95	71246.50	44026.55	1.62
6.	Nitrogen (30 kg/ha) + Imazethapyr (75 g/ha) Post-emergence	27469.95	73505.50	46035.55	1.68
7.	Nitrogen (45 kg/ha) + Hand weeding twice (20 & 40 DAS)	27469.95	76231.50	48761.55	1.78
8.	Nitrogen (45 kg/ha) + Pendimethalin (0.75 ml/ha) Pre-emergence	27369.95	79369.00	51999.05	1.90
9.	Nitrogen (45 kg/ha) + Imazethapyr (75 g/ha) Post-emergence	27619.95	83109.00	55489.05	2.01
10.	Control plot (RDF)	25919.95	52772.10	26852.15	1.04

Table 2. Influence of nitrogen and weed management on economics of blackgram.