

Original Research Article

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Yield Attributes and Yield of Urdbean as Influenced by Foliar Application of Salicylic Acid under Rainfed Condition

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ABSTRACT

The experiment was conducted in the department of Plant Physiology C S Azad University of Agriculture & Technology. Kanpur in field during kharif session 2017 adopted Randomized Block Design with 10 treatments and Azad - 3 variety including control and each treatment was replicated three times with three levels of salicylic acid i.e. 50, 100 and 150 ppm at the time of 20 DAS, 40 DAS and 60 DAS which was given through foliar application. Results maximum increase in yield and yield attributes viz., number of pods/plant, dry weight/plant, seed yield/plant, 100 seed weight (g), seed yield q/ha and harvest index(%) was recorded under the treatment of salicylic acid @ 150 ppm followed by 100 and 50 ppm of salicylic acid over control. Thus, in general it may be concluded that the foliar application of salicylic acid @ 150 ppm was found optimum concentration in enhancing yield of Black gram over rest of treatment under rain fed conditions.

Keywords

Foliar application,
salicylic acid, Day after
Sowing, Parts per million,
Treatment

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Introduction

Blackgram is one of the most highly prized pulse crop, cultivated in almost all parts of India. It has inevitably marked itself as the most popular pulse and can be most appropriately referred to as the “king of the pulses” due to its mouth watering taste and numerous other nutritional qualities. Whether it be the very special “Dal makhni” of Punjab

or the “Vada Sambhar” of South India, the taste rules the hearts of one and all alike. Indian immigrants have popularized the taste worldwide as well.

In Japan, the health conscious people eat these seeds by soaking them in water overnight and then serving them as fresh bean sprout salad which is highly nutritious. Blackgram is perfect combination of all nutrients, which

includes proteins (25-26%), carbohydrates (60%), fat (1.5%), minerals, amino acids and vitamins. The decreasing per capita availability of pulses from 1951 in 60.7 g and 2000 in 35.9 g of great concern in the India contest where most of the peoples are vegetarian. An average adult man would require boy and adult woman 50 g of protein per day.

Black gram also known as urd, mash in India. In India total black gram production was estimated 14.76 million tonnes from 23.63 million hectare area with productivity of 642 kg/ha. Grain legumes occupy a unique position in Indian agriculture as they provide vegetable protein for human diet, pulse are also important in our agriculture system because of their nitrogen fixing ability about 40% of the total nitrogen in the world is added by leguminous plant. They can also suit to dry farming condition because of their ability to trap moisture from deep layers of the soil by virtue of their deep penetrating root system.

In India, it is the fourth important pulse crop after chickpea and pigeon pea, green gram is cultivated in state of Rajasthan, Madhya Pradesh, Punjab, Haryana, U.P., Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. In Uttar Pradesh, it is being cultivated in an area of 3.91 lakhs hectare with 1.72 lakhs tonnes production Anonymous (2014).

The main reason of low productivity of the green gram is cultivation on marginal and sub-marginal lands with no use of recommended dose of fertilizers. Flowering is important parameter that is directly related to yield and productivity of plants. Salicylic acid has been reported to induce flowering in a number of plants. Different plant species including ornamental plant *Sinningia speciosa* flowered much earlier as compared to the untreated control, when they received an exogenous foliar spray of salicylic acid.

Materials and Methods

The experiment was conducted geographically, Kanpur is situated in the central part of U.P. and subtropical tract of North India between latitude ranging from 25° 56' to 28° 58' North and longitude 79° 31' to 80° 34' East and is located on an elevation of about 125.9 meters above mean sea level in gangetic plain. The seasonal rainfall of about 816 mm received mostly from IInd Fortnight of June or first Fortnight of July to mid-October with a few showers in winter season.

The experiment was conducted in randomized block design with 3 replications. Seed of Azad-3 variety were used in this experiment.

Pure seeds of variety were obtained from the Economic botanist (Legume section) of this University.

Treatment combination and symbols

Control - T₁

Foliar application of salicylic acid @ 50 ppm (20 DAS) - T₂

Foliar application of salicylic acid @ 50 ppm (40 DAS) - T₃

Foliar application of salicylic acid @ 50 ppm (60 DAS) - T₄

Foliar application of salicylic acid @ 100 ppm (20 DAS) - T₅

Foliar application of salicylic acid @ 100 ppm (40 DAS) - T₆

Foliar application of salicylic acid @ 100 ppm (60 DAS) - T₇

Foliar application of salicylic acid @ 150 ppm (20 DAS) - T₈

Foliar application of salicylic acid @ 150 ppm (40 DAS) - T₉

Foliar application of salicylic acid @ 150 ppm (60 DAS) - T₁₀

Application of fertilizers

The experimental field was fertilized with recommended dose of NPK /ha @ 20 Kg N, 40 Kg P₂O₅ and 20 Kg K₂O. Basal manuring experimental field was ploughed once with a soil turning plough and two ploughings with desi plough. Finally, it was planked to give a uniform level. The sowing was done in plot with plant to plant 40 cm, row to row 10 cm and depth 5-8 cm below. All the data analysis related to yield and yield contributing characters as well as chemical analysis were statistically analyzed by the methods suggested by Fisher (1935). Plant sampling method randomly three plants were taken out from each urdbean variety at different growth stages, and the data on different traits were recorded on these plants.

Results and Discussion

Effect of salicylic acid on yield attributes of urdbean

Above observations were recorded at different stages as 35 DAS, 70 DAS, and harvesting and sprayed of the salicylic acid at 20 DAS 40 DAS and 60 DAS on the foliar application. All level of foliar application of salicylic acid better response in yield attributes viz. that number of pods, 100 seed economic yield, biological yield, harvest index and yield varied significantly due to foliar application of salicylic acid treatment and their significantly.

Maximum value of all traits obtained in T₁₀ under salicylic acid (150 ppm) comparison of all other treatments as well as control. Yield and yield attributes were reported significant results in salicylic acid T₁₀, T₉, T₈ in higher

comparison to salicylic acid 100 ppm T₇, T₆, T₅, and salicylic acid 50 ppm T₄, T₃, T₂ and all treatments give significant results than control (T₁). Among the different levels of salicylic acid, application @ 150 ppm was found significantly better and positively influenced all traits under rain fed conditions. Coefficient variance revealed that yield possessed significantly positive yield attributes and yields indicates involvement of these traits in yield formation process under stress environment condition.

Number of pods/plant

A perusal of data on number of pods as presented in Table 1 and Figure 1 showed that different levels of treatments significantly increased the number of pods over control at harvest stage. Maximum number of pods was recorded in the treatment of salicylic acid 150 ppm 60 DAS closely followed by salicylic acid -150 ppm. 40 DAS and over controls. It was inferred that application of salicylic acid similar result was also reported Sujatha (2001), Amin *et al.*, (2009) and Ali and Mahmoud (2013) number of pods per plant components of urdbean.

Dry weight of pods

Data as depicted in Table 1 and Figure 1 showed that foliar application of salicylic acid @ 150 ppm influenced dry weight of pods at maturity stages of crop growth. Significantly higher dry weight was observed in (T₁₀) 8.99 each other treatment. Similar result was also reported Amin *et al.*, (2009), Ali and Mahmoud (2013) and Sathiyamurthy *et al.*, (2017) number of pods per plant components of urdbean.

Seed yield per plant

The data presented in Table 2 and Figure 2 revealed that the seed yield per plant significantly increased. Maximum seed yield

per plant was recorded by the treatment (T₁₀) and other all treatment over control. The application of salicylic acid conferred an increase in leaf area. An improvement in leaf

area following SA application in plants grown under saline conditions was also reported by Sathiyamurthy *et al.*, (2017).

Table.1 Effect of different doses of salicylic acid on number of pod and dry weight of pod per plant at maturity of black gram during 2017

Treatment	No. of pod at maturity	Dry weight of pod at maturity
Control - T ₁	21.00	5.00
FA of SA 50 ppm 20 DAS -T ₂	23.66	5.61
FA of SA 50 ppm 40 DAS -T ₃	25.00	5.86
FA of SA 50 ppm 60 DAS -T ₄	28.00	6.19
FA of SA 100 ppm 20 DAS -T ₅	30.33	6.36
FA of SA 100 ppm 40 DAS -T ₆	34.66	6.93
FA of SA 100 ppm 60 DAS -T ₇	37.66	7.32
FA of SA 150 ppm 20 DAS -T ₈	41.33	7.90
FA of SA 150 ppm 40 DAS -T ₉	44.33	8.39
FA of SA 150 ppm 60 DAS -T ₁₀	46.00	8.99
CD	2.50	0.60
SE(D)	1.18	0.28
CV	4.36	5.08

Note- FA - Foliar application, SA - salicylic acid, DAS - Day after Sowing, PPM - Parts per million and T - Treatment symbols

Table.2 Effect of different doses of salicylic acid on seed yield per plant and test weight (g) per plant at maturity of black gram during 2017

Treatment	Seed yield per plant	Test weight (g)
Control - T ₁	2.44	3.24
FA of SA 50 ppm 20 DAS -T ₂	2.62	3.32
FA of SA 50 ppm 40 DAS -T ₃	2.98	3.52
FA of SA 50 ppm 60 DAS -T ₄	3.23	3.59
FA of SA 100 ppm 20 DAS -T ₅	3.59	3.70
FA of SA 100 ppm 40 DAS -T ₆	3.97	3.76
FA of SA 100 ppm 60 DAS -T ₇	4.52	3.94
FA of SA 150 ppm 20 DAS -T ₈	5.49	4.03
FA of SA 150 ppm 40 DAS -T ₉	6.06	4.27
FA of SA 150 ppm 60 DAS -T ₁₀	6.66	4.41
CD	0.46	0.14
SE(D)	0.28	0.06
CV	6.40	2.20

Note- FA - Foliar application, SA - salicylic acid, DAS - Day after Sowing, PPM - Parts per million and T - Treatment symbols

Table.3 Effect of different doses of salicylic acid on yield q/ha and harvest index (%) after maturity of black gram during 2017

Treatment	Biological yield q/ha	Seed yield q/ha	Harvest index (%)
Control - T ₁	12.35	8.20	18.21
FA of SA 50 ppm 20 DAS -T ₂	13.72	8.40	19.08
FA of SA 50 ppm 40 DAS -T ₃	14.76	8.90	20.18
FA of SA 50 ppm 60 DAS -T ₄	15.56	9.30	20.75
FA of SA 100 ppm 20 DAS -T ₅	16.29	9.45	22.02
FA of SA 100 ppm 40 DAS -T ₆	17.50	9.85	22.68
FA of SA 100 ppm 60 DAS -T ₇	18.47	9.95	24.46
FA of SA 150 ppm 20 DAS -T ₈	19.76	10.10	27.77
FA of SA 150 ppm 40 DAS -T ₉	20.86	10.20	29.04
FA of SA 150 ppm 60 DAS -T ₁₀	21.97	10.35	30.30
CD	1.98	0.014	0.14
SE(D)	0.93	0.007	0.06
CV	6.68	0.088	0.35

Note- FA - Foliar application, SA - salicylic acid, DAS - Day after sowing, PPM - Parts per million and T - Treatment symbols

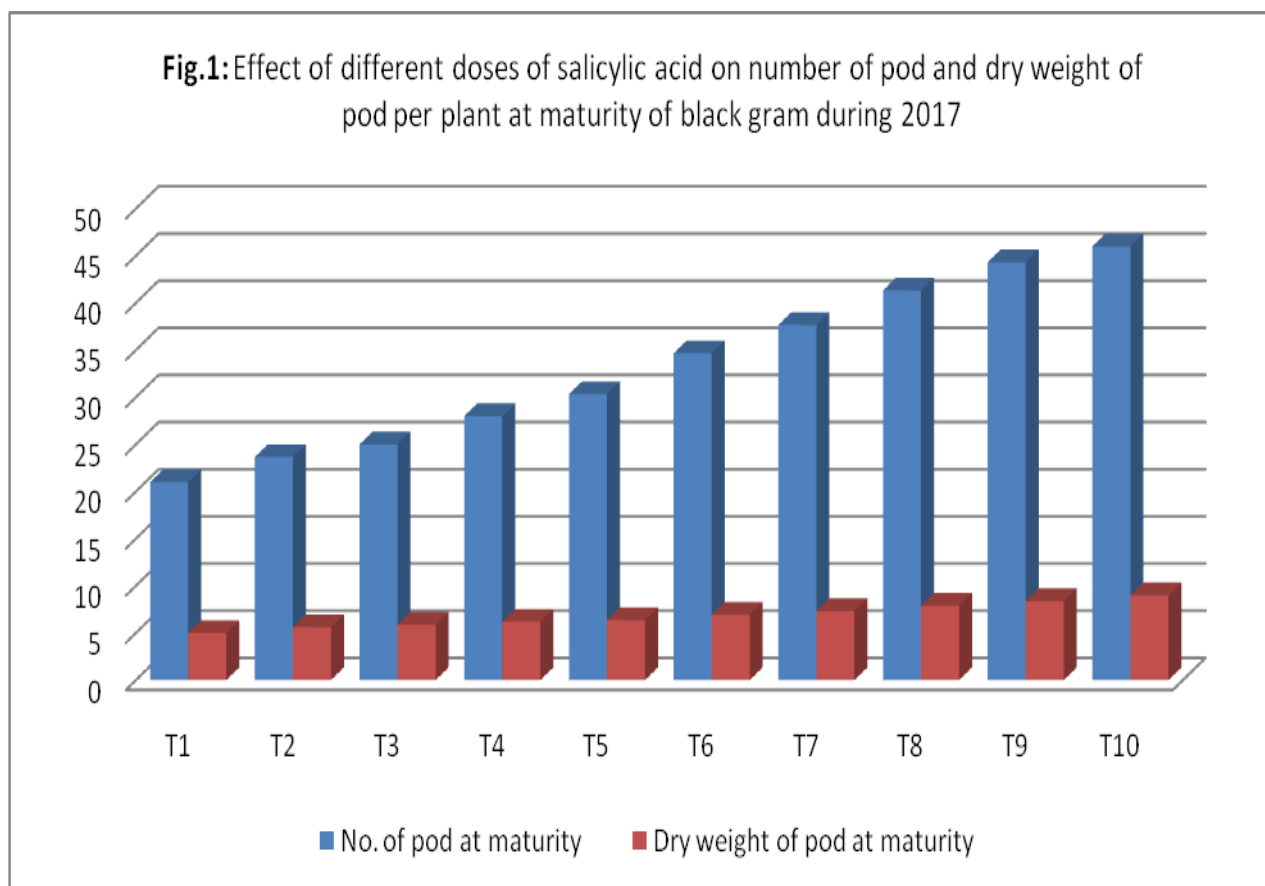


Fig.2: Effect of different doses of salicylic acid on seed yield per plant and test weight (g) per plant at maturity of black gram during 2017

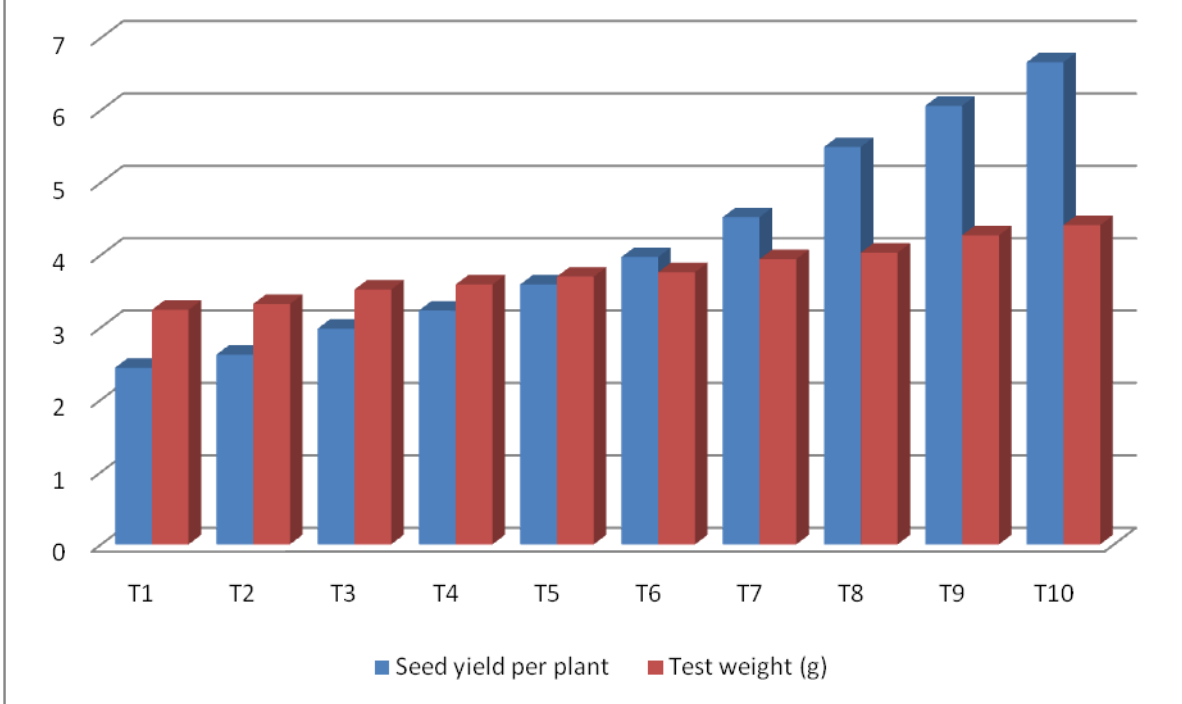
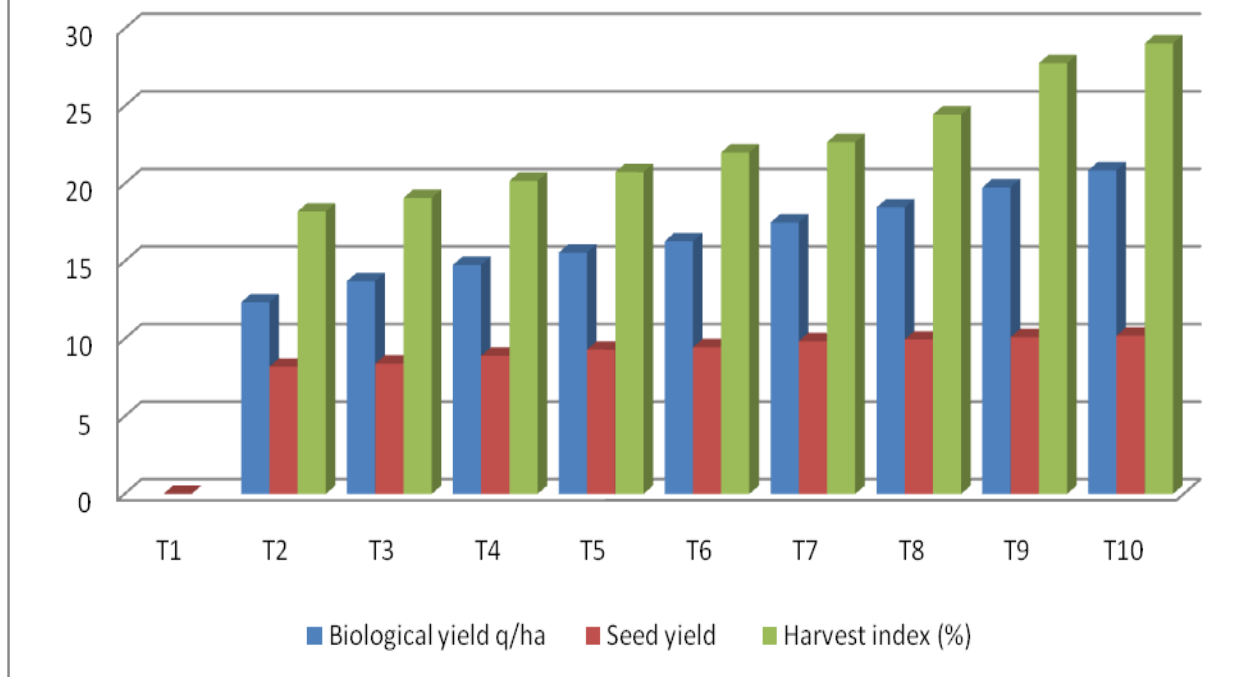


Fig.3: Effect of different doses of salicylic acid on yield q/ha and harvest index (%) after maturity of black gram during 2017



Seed test weight (g)

Different foliar application of salicylic acid treatments significantly increased the seed index weight over the control. The maximum 100 seed weight was obtained treatment (T₁₀) wt. 4.41g followed by all other treatment. Similar result was also reported Sujatha (2001), Ali and Mahmoud (2013), Sathiyamurthy *et al.*, (2017) number of pods per plant components of urdbean crops.

Effect of salicylic acid on yields and harvest index of urdbean

The seed yield per unit area is an important scale for agronomic assessment of the crop. The suitability of the treatment is best judged by their efficiency to produce higher yield. Yield of any crop is the ultimate result of interaction of the biotic and environment factors. The superiority or inferiority of any treatment could be judged by magnitude of changes brought in the productivity.

Biological yield q/ha

A perusal of data on harvest index as presented in Table 3 and Figure 3 the data recorded on biological yield in kg/ha was converted into seed yield in quintals/ha the data revealed that all the foliar application of salicylic acid gave significant response on seed yield over control treatments (T₁). The maximum grain yield (21.97 q/ha) in treatment (T₁₀) was recorded with the foliar application of salicylic acid @ 150 ppm at 60 DAS. It was found significantly superior than all the other treatments the minimum biological yield (12.35 q/ha) was recorded in control treatment (T₁). Similar result was also reported Ali and Mahmoud (2013) and Sathiyamurthy *et al.*, (2017) seed yield and yield components of urdbean.

Seed yield q/ha

A perusal of data on harvest index as presented in Table 3 and Figure 3 the data recorded on seed yield in kg/ha were converted into seed

yield in quintals/ha the data revealed that all the foliar application of salicylic acid gave significant response on seed yield over control treatments (T₁). The maximum grain yield (10.35 q/ha) in treatment (T₁₀) was recorded with the foliar application of salicylic acid @ 150 ppm at 60 DAS. It was found significantly superior than all the other treatments the minimum seed yield (8.20 q/ha) was recorded in control treatment (T₁). Foliar application of different treatment of salicylic acid had significant variation in the biological and seed yield of black gram. Among the treatments, foliar application of salicylic acid 150 ppm at 60 DAS recorded significantly higher both yield. Similar result was also reported Ali and Mahmoud (2013) and Sathiyamurthy *et al.*, (2017) seed yield and yield components of urdbean.

Harvest index

A perusal of data on harvest index as presented in Table 3 and Figure 2 showed that it varied significantly due to foliar application of salicylic acid treatment. Harvest index increased significantly in treatment (T₁₀) over each other treatment. Further, it also appears that application of salicylic acid @ 150 ppm at 60 DAS resulted in significantly higher 30.30 % over control 18.21 % over rest of treatments. Harvest index as depicted in us that it varied significantly due to variation, treatment of foliar application of salicylic acid @ 150 ppm recorded high yield and harvest index from the result it appears application of salicylic acid @ 150 ppm had positive effect on yield and harvest index. A similar result was also established by Ali and Mahmoud (2013) and Sathiyamurthy *et al.*, (2017).

Above observations were recorded at different stages as 35 DAS, 70 DAS, and harvesting and sprayed of the salicylic acid at 20 DAS 40 DAS and 60 DAS on the foliar application. All level of foliar application of salicylic acid better response in yield attributes viz. that number of pods, 100 seed economic yield, biological yield, harvest index and yield varied significantly due

to foliar application of salicylic acid treatment and their significantly. The results obviously suggest and it may be concluded that foliar application of salicylic acid on urdbean variety Azad – 3 significantly change in plant morphology, improvement in vegetative and reproductive growth to enable them for higher yield build up and the affects initiated once were carried over through the life cycle of plant. These substances judiciously work out can be employed successfully for yield maximization of urdbean.

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