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Effect of plant growth regulators and fertilizer spray on growth and yield of Niger[*Guizotia abyssinica* (L.f.) Cass]

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Abstract
A field experiment was conducted during *kharif* season of the year 2018-19 at farm, Department of Agronomy, College of Agriculture, VNMKV, Parbhani to study the effect of plant growth regulators and fertilizer spray on growth and yield of Niger [*Guizotia abyssinica* (L.f.) Cass]." The investigation was carried out in RBD design with three replication and ten foliar application of plant growth regulators and fertilizers such as T_1- 19:19:19 (1%), T_2 - Urea (1%) + DAP (1%), T_3 - DAP (2%), T_4 - Urea(2%), T_5 - Brassinosteroids (0.05%), T_6 -NATCA (50ppm), T_7 – NAA (20ppm), T_8- GA_3(20ppm), T_9 - Nitrobenzene (400ppm), T_{10} - Control (no spray). The result of experiment revealed that among the treatments foliar application of Brassinosteroids (0.05%) (T_5) to Niger at bud initiation stage recorded significantly higher growth, yield attributes and yield as compare to other treatments and which was at par with foliar application of NATCA(50PPM) and nitrobenzene(400PPM).

Keywords: Niger, growth regulators, foliar application, Brassinosteroids, Natca, growth, yield attributes, yield

Introduction
Niger crop [*Guizotia abyssinica* (L.f.) Cass] belongs to family compositae and originated in Ethopia. Niger is a minor oilseed crop that is predominantly cultivated under rainfed conditions. Its cultivation in India is mostly in rainfed areas on poor soil having coarse texture, especially on hilly slopes. Niger crop seed is used in human food as chutneys and other traditional food preparations. The seed contain 37-40% oil, which is pale yellow and nutty taste and has a pleasant odour. In India, it is mainly grown in states of Madhya Pradesh, Bihar, Maharashtra, Orissa, Karnataka and Tamil Nadu. In India, Niger crop is grown on area of 218.48 Lakh/ha with production of 70.19 lakh tonnes and an average yield 321 kg ha^{-1} (Anonymous, 2019) [1].

Plant growth regulators play important role in plant growth and development, but little is known about the roles of plant growth regulators in improving the yield components and seed qualities of Niger crop. Foliar applications of nutrient and PGRs is used during or before stress and at the time of flowering to improve the growth and yield. DAP, 19:19:19 and urea is commonly used for foliar fertilization. The new generation of chemical *viz*., Acetyl Thiazolidine 4- Carboxylic acid (NATCA), Nitrobenzene and Brassinosteroids are also reported to increase flowering and help in changing the physiology of crop to increase the yield. Foliar application of Urea and DAP gave better performance regarding growth and yield attributes (Dalei *et. al* 2014) [2]. Foliar application of 19:19:19 results in increase in the yield (Gutte *et al*, 2018) [3]. The nutrients supplied through them helps in overcoming stress and promote proper growth of rainfed grown crop, if applied at proper stage of crop growth. Foliar spraying 40 ppm NAA increases plant height, number of primary branches and leaf area at all the different stages (Tamilselvi, 2014) [8].

Materials and Methods
The field experiment was conducted during *kharif* season of the year 2018-19 at farm, Department of Agronomy, College of Agriculture, VNMKV, Parbhani to study the effect of

plant growth regulators and fertilizer spray on growth and yield of Niger [*Guizotia abyssinica* (L.f.) Cass]."

The experimental field was levelled and well drained. The soil was clayey in texture, low in nitrogen (178.00 kg ha^{-1}), low in phosphorus (12.15 kg ha^{-1}), rich in potash (488 kg ha^{-1}) and alkaline in reaction.

The experiment was designed in Randomized Block Design with ten (10) treatments and replicated thrice. The treatments details are : T_1- 19:19:19 (1%), T_2 - Urea (1%)+ DAP (1%), T_3 - DAP (2%), T_4 - Urea(2%), T_5 - Brassinosteroids (0.05%), T_6 - NATCA (50ppm), T_7 – NAA (20ppm), T8- GA_3 (20ppm), T_9 - Nitrobenzene (400ppm), T_{10} - Control (no spray).

The net plot size was 4.5 m x 4.1 m. Sowing was done on 4th July, 2019. The spacing of 30 cm × 10 cm was maintained. The recommended cultural practices and plant protection measures were taken.

Results and Discussion

The effect of different treatments was noticed on important growth parameters *viz*., plant height, leaf area, and total dry matter per plant was influenced significantly due to foliar application of growth regulators and fertilizers.

Table 1: Growth attributes of Niger as influenced by various treatments

Sr.no.	Treatments	Plant height (cm)	Leaf area (dm^2)	Number of branches $plant^{-1}$	Total dry matter (g)
T1	19:19:19(1%)	92.54	12.50	17.26	14.51
T2	Urea(1%)+DAP(1%)	90.84	10.29	15.32	13.51
T3	DAP(2%)	90.19	11.40	16.30	14.32
T4	Urea(2%)	89.33	10.21	14.23	13.17
T5	Brassinosteroids(0.05%)	84.77	16.26	20.82	16.00
T6	NATCA(50PPM)	81.23	15.62	19.71	15.86
T7	NAA(20PPM)	80.66	13.56	17.60	14.79
T8	GA3(20PPM)	84.14	9.81	14.73	13.25
T9	Nitrobenzene(400PPM)	82.28	14.30	19.63	15.30
T10	Control(No spray)	75.60	7.12	11.18	11.67
	SE(m)+	2.15	0.70	0.53	0.45
	C.D. at 5%	6.38	2.08	1.56	1.34
	General mean	85.16	12.11	16.68	14.24

Plant height and its rate of increase were found to be significant amongst different treatments. Application 19:19:19(1%)(T_1) to Niger crop at flowering and capsule formation stage was higher in respect of plant height compared with rest of the treatments. The increase in plant height may be due to better absorption and translocation of plant growth regulators to growing tip. These results are in conformity with Gutte *et al.* (2018) [3] and Shweta *et al.* (2018) [6].

The data on mean of leaf area (dm^2) $plant^{-1}$ revealed that Treatment of Brassinosteroides (0.05%) (T_5) proved to be superior in retaining more number of leaf area (dm^2) $plant^{-1}$, than other treatments. But it was on par with NATCA (50PPM) (T_6) and Nitrobenzene (400PPM) (T_9). Similar results were found by Ramesh and Ramprasad (2013) [5].

It was observed from the data presented in Table 1 that mean number of branches $plant^{-1}$ were influenced significantly by various treatments under study and treatment of Brassinosteroides (0.05%) (T_5) recorded maximum number of branches (16.68) followed by NATCA (T_6) (50PPM) and Nitrobenzene (T_9) (400PPM). However, Brassinosteroides (0.05%) (T_5) was significantly superior over rest of all treatments.

It was observed from the data presented in Table 1 that, foliar application of Brassinosteroides (0.05%) (T_5) recorded highest dry matter production $plant^{-1}$ than the rest of treatments but found at par with treatment NATCA (T_6) and Nitrobenzene (T_9). The increase in total dry matter accumulation $plant^{-1}$ may be due to profound effect of Brassinosteroides, NATCA and Nitrobenzene which supply nutrients, result into higher vegetative growth, increase in better absorption and translocation of plant nutrients and growth regulators by growing plants. These results are in conformity with Ramesh and Ramprasad (2013) [5].

Table 2: Yield and yield attributes influenced by different treatments

Trt. No.	Treatments	No. of capsule $plant^{-1}$	No. of seed $plant^{-1}$	Wt. capsule $plant^{-1}$	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})
T_1	19:19:19(1%)	22.05	442.33	2.31	483	1955	2438
T_2	Urea(1%)+DAP(1%)	21.33	440.33	1.91	474	1836	2310
T_3	DAP(2%)	21.73	446.67	2.01	480	2063	2543
T_4	Urea(2%)	20.00	406.67	1.85	443	1822	2265
T_5	Brassinosteroids(0.05%)	26.00	491.67	3.68	531	2030	2561
T_6	NATCA(50PPM)	24.00	483.00	2.96	508	1964	2472
T_7	NAA(20PPM)	22.00	446.00	2.78	487	2147	2634
T_8	GA_3(20PPM)	20.00	406.67	1.75	438	1715	2153
T_9	Nitrobenzene(400PPM)	23.00	460.33	2.84	501	1956	2457
T_{10}	Control(No spray)	19.00	358.33	1.66	400	1748	2148
S.E.(m) ±		0.93	0.93	0.25	13.49	6.36	7.34
C.D. at 5%		2.78	2.78	0.75	40.07	18.99	21.53
General mean		21.91	21.91	2.38	474.65	1923.73	2398

Almost all the yield attributing characters *viz*., number of capsule $plant^{-1}$, number of seeds $plant^{-1}$, weight of capsule

plant^{-1}, seed yield (kg ha^{-1}), straw yield (kg ha^{-1}) and biological yield (kg ha^{-1}) were significantly influenced by various treatments.

Application of Brassinosteroides (0.05%)(T_5) recorded significantly higher number of capsule plant^{-1}, number of seeds plant^{-1}, indicating the more availability nutrients at crucial growth stages under this treatments ultimately improved all yield attributes besides increased rate of N, P, K and micronutrients absorption cumulatively helped the crop plants to produce more surface area for high photosynthetic rate as well as maximum translocation of photosynthesis from source to sink, subsequently resulted in improvement of all yield attributes. Because of synergetic effect among the yield attributes they benefited each other. Similar result was found by Ramesh and Ramprasad (2013) [5] and Singh (2007) [7].

Seed yield was a function of yield attributes. Similarly, biological yield of crop plant has a close relationship with its economical yield. Data presented in (Table 2) reported that the per hectare seed yield and straw yield of Niger crop were appreciably higher in all the treatments as compared to Control (T_{10}). Brassinosteroids (0.05%) (T_5) recorded significantly higher seed yield but remained statistically at par with the application of NATCA (50PPM) (T_6) and Nitrobenzene (400PPM) (T_9). This might be due to higher seed yield plant^{-1} which occurred from increased capsule number, and number of seeds plant^{-1}. While the lowest number of capsule plant^{-1}, weight of capsule plant^{-1} and straw yield (kg ha^{-1}) were recorded in Control (No spray) (T_{10}) due to lower availability of available nutrients. These results are in conformity with Ramesh and Ramprasad (2013) [5].

Conclusion

On the basis of present investigation it may be concluded that for getting maximum height foliar application of 19:19:19(1%)(T_1) and combination of Urea (1%) + DAP (1%) (T_2) was found best to Niger crop. More growth, yield attributes and yield i.e, leaf area, number of branches, Total dry matter and yield attributing characters *viz*., number of capsule plant^{-1}, number of seeds plant^{-1}, weight of capsule plant^{-1} (gm), seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), and biological yield (kg ha^{-1}) were found more profitable with application of Brassinosteroids (0.05%) (T_5), NATCA (50PPM) (T_6) and Nitrobenzene (400PPM) (T_9) to Niger crop.

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