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Yield and economics of Niger as influenced by water soluble fertilizer spray and plant growth regulators

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Abstract
A field trial was carried out at farm, Department of Agronomy, College of Agriculture, VNMKV, Parbhani during kharif season of 2019-20 to study the effect of plant growth regulators and fertilizer spray on yield and economics of Niger [*Guizotia abyssinica* (L.f.) Cass]." The experiment was laid out in RBD design with three replication and ten foliar sprayings 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 yield (531kg ha^{-1}) and gross monetary return(31229₹ha^{-1}) as compare to other treatments and which was at par with foliar application of NATCA(50PPM) and nitrobenzene(400PPM).

Keywords: Niger, growth regulators, brassinosteroids, NATCA, growth, economics, yield

Introduction
Niger [*Guizotia abyssinica* (L.f.) Cass] is an edible oilseed crop which is extensively grown by the resource poor farmers mainly in tribal areas under rainfed condition. Niger seeds contain a considerable quantity of edible oil (38 to 43%), protein (20%) and minerals essential for human and animal meals (Gentinet and Teklewold 1995) [5]. In India, 25 percent of the seed is used for oil. When extracted the oil is used in foods, for paint and soap making and for lighting, In India about 75 percent of the harvested seeds are used for oil extraction while the rest is exported for bird feed. Roasted or fried seeds are eaten as a snack or used as condiment. The press cake from oil extraction contains 31 to 40 percent protein and is used for feeding cattle.

Niger is grown in tropical and subtropical countries like India, Ethiopia, East Africa, West Indies and Zimbabwe. However, India and Ethiopia are two major Niger producing countries in the world. India ranks on the second and forth position in the world for its acerage and annual production respectively. It is extensively grown in Madhya Pradesh, Chhattisgarh, Orissa. The major plant nutrients applied through chemical fertilizers may not be taken up properly by plant roots of crop plants due to organic carbon content and water holding capacity of soil. The applied little quantity of nitrogen is generally lost either by leaching or volatilization. Under such circumstances, nitrogen application can be done in the forms of foliar spray to avoid the aforesaid losses of nitrogen (Jaiswal and Elamathi 2007) [6]. 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. Crops grown in rainfed areas often face moisture stress during crop growth. Foliar application of crop growth regulators and nutrients can help in overcoming the stress and improve the yield. An attempt has been made to elaborate the subject with emphasis on important plant growth regulators *viz*., auxins, gibberllins, NATCA, Brassinosteriods and fertilizer *viz*., urea, DAP and 19:19:19. It is observed that plant growth regulators when applied in proper stage of growth and concentration influenced positively the yield components and yield of Niger crop. Keeping this in view attempts were made to know the agronomic aspect of application of nutrients and PGRs on Niger crop.

Materials and Methods
The field experiment was conducted to study the effect of plant growth regulators and fertilizer spray on yield and economics of Niger [*Guizotia abyssinica* (L.f.) Cass]." during *kharif* season of the year 2019-20 at farm, Department of Agronomy, College of Agriculture, VNMKV,

Parbhani. The experimental field was levelled and well drained. 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), T9 - 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

Table 1: Mean seed yield, straw yield, biological yield (kg ha^{-1}) and Harvest Index of Niger as influenced by different treatments

Tr. No.	Treatments	Yield (kg ha^{-1})			Harvest index %
		Seed	Straw	Biological	
T_1	19:19:19(1%)	483	1955	2438	19.81
T_2	Urea(1%)+DAP(1%)	474	1836	2310	20.51
T_3	DAP(2%)	480	2063	2543	18.87
T_4	Urea(2%)	443	1822	2265	19.55
T_5	Brassinosteroids(0.05%)	531	2030	2561	20.73
T_6	NATCA(50PPM)	508	1964	2472	20.55
T_7	NAA(20PPM)	487	2147	2634	18.48
T_8	GA_3(20PPM)	438	1715	2153	20.34
T_9	Nitrobenzene(400PPM)	501	1956	2457	20.39
T_{10}	Control(No spray)	400	1748	2148	18.62
SE (m)+		13.49	6.36	7.34	--
C.D. at 5%		40.07	18.99	21.53	--
General mean		474.65	1923.73	2398	19.78

Effect on yield of Niger crop

Yield of Niger *viz*., seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest index (%) were significantly influenced by various treatments.

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 1) 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 $plant^{-1}$. While the lowest seed yield (kg ha^{-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) [9].

Economics of the Niger crop

Table 2: Economics of Niger production as influenced by different treatments

Tr. No.	Treatments	Gross monetary returns (₹ha^{-1})	Cost of cultivation (₹ha^{-1})	Net monetary returns (₹ha^{-1})	B:C ratio
T_1	19:19:19(1%)	28497	17750	10747	1.60
T_2	Urea(1%)+DAP(1%)	27966	18085	9881	1.54
T_3	DAP(2%)	28321	17950	10371	1.57
T_4	Urea(2%)	26137	17000	9137	1.53
T_5	Brassinosteroids(0.05%)	31229	18100	13129	1.72
T_6	NATCA(50PPM)	29972	18000	11972	1.66
T_7	NAA(20PPM)	28733	17950	10783	1.60
T_8	GA_3(20PPM)	25842	16910	8932	1.52
T_9	Nitrobenzene(400PPM)	29560	17950	11610	1.64
T_{10}	Control(No spray)	23600	15500	8100	1.52
SE(m)+		627.50	-	510.74	-
C.D. at 5%		1864.48	-	1517.53	-
General mean		27986	-	10466	1.59

Gross and net monetary returns of Niger crop were significantly influenced due to different input factors Table 2. Treatment Brassinosteroids (0.05%) (T_5) to Niger crop recorded significantly highest gross and net monetary returns as compared to rest of treatments. The effect of input factors on gross monetary return and net monetary returns was found to be significant. Application of Brassinosteriods (0.05%) (T_5) to Niger crop was significantly superior over all other treatments and produced highest gross monetary returns of (₹ 31229 ha^{-1}) and which was found on at par with treatment and NATCA (50PPM) (T_6) ((₹ 29972 ha^{-1}) and Nitrobenzene (400PPM) (T_9) ((₹ 29560ha^{-1}). Lowest gross monetary return of Niger was obtained by control treatment (T_{10}) ((₹ 23600 ha^{-1}). Similar type of trend was observed in net monetary returns. Application of Brassinosteroides (0.05%) (T_5) to Niger crop recorded significantly highest net monetary return ((₹13129 ha^{-1}) and found at par with treatment NATCA (50PPM) (T_6) and Nitrobenzene (400PPM) (T_9).

Conclusion

Based on the results from the investigation it is concluded that foliar application of Brassinosteriods (0.05%) (T_5), NATCA (50PPM) (T_6) and Nitrobenzene (400PPM) (T_9) at bud initiation stage to Niger give higher seed yield and monetary return.

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