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Studies on growth, yield and quality of niger (*Guizotia abyssinica* Cass) as influenced by graded levels of fertilizer and plant density

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Abstract
A field experiment was conducted during kharif 2017 at Experiment Farm, Department of Agronomy, College of Agriculture, Latur, to study the effect of fertilizer grades and plant density on niger. The soil was clayey in texture, low in available nitrogen (135.31 kg ha-1), medium in phosphorus (19.42 kg ha-1), high in potassium (444 kg ha-1) and slightly alkaline in reaction (8.1 pH). The experiment was laid out in a Factorial Randomized Block Design consisting three fertilizer grades *viz*. 30:15:00 NPK kg ha-1 (F1), 40:20:00 NPK kg ha-1 (F2) and 50:25:00 NPK kg ha-1 (F3) and four spacing of 30 cm x 10 cm (S1), 30 cm x 15 cm (S2) and 45 cm x 10 cm (S3) and 45 cm x 15 cm (S4) replicated thrice. The results indicated that growth and yield attributing characters of niger *viz*. number of functional leaves, leaf area, number of flower heads plant-1, number of branches, total dry matter, seed yield per plant and test weight were appreciably improved with the spacing of 45 x 15 cm. The spacing of 30 x 15 cm was found to be significantly effective in producing higher seed yield (kg ha-1), oil yield (kg ha-1), gross monetary returns, net monetary returns and B: C ratio which was at a par with the spacing of 30 x 10 cm and significantly superior over rest of the spacing. Higher growth and yield attributes under wider spacing (45 x 15 cm) might be due to more availability of space, nutrients and moisture while higher seed and oil yield as well as monetary return obtained by closer spacing of 30 x 15 cm due to the optimum space and plant population per unit area. Among different fertilizer levels, the application of 50:25:00 NPK kg ha-1 produced significantly higher growth and yield attributing characters, higher seed yield and oil yield (kg ha-1), gross and net monetary returns with higher B: C ratio as compared to 30:15:00 NPK kg ha-1 and it was at par with 40:20:00 NPK kg ha-1. The higher growth and yield obtained by the higher level of 50:25:00 NPK kg ha-1 might be due to the availability of sufficient amount and nutrients made available to the niger crop to exploit the yield potential. But it was statistically comparable with the fertilizer grade of 40:20:00 NPK kg ha-1.

Keywords: Fertilizer levels, niger, alkaline etc.

Introduction
Oilseeds is the second largest agricultural commodity after cereals sharing 13 per cent of the country's gross cropped area. It contributes nearly 6 per cent of gross national production and 10 per cent of the value of all agricultural commodities. About 14 million persons are engaged in production of oilseeds and another 0.5 million people in their processing thus the oilseeds are important in Indian farming because import of oil per annum is Rs.4700 hundred crores. They are grown on all types of soils and helps in crop rotation with millets and pulses. Oil seed crop maintains soil fertility and reduces cost of cultivation for succeeding crops. They are the source of foreign exchange through export. They attribute vegetable oils and fats to the diet. They provide row materials for many industries e.g. paints, varnishes, soaps, lubricants etc. The important features of this crop are that it gives satisfactory seed yield even under poor growing conditions with little care, expenditure and effort. The plant has a deep root system which endows it with high degree of drought tolerance in deep soils under rainfed dry conditions. The crop is attacked by insect pest, diseases and also by stray and wild animals grazing freely in areas where this crop is grown. Niger can withstand high soil moisture levels, and water logging as well. The niger seed has a total ash content of 4.58 per cent containing acid insoluble (1.01%) and acid soluble (3.57%) fractions, the latter containing iron (Fe2 O3), 0-04%, lime (CaO), 0.12%, Phosphoric acid (P2 O5), 1.35% and water soluble chloride (NaCl), 0.02% (Daji, 1943). There has been a serious imbalance in the availability through domestic production and demand of oil in the country because of phenomenal increase in human population.

The increased demand of edible oils in country and low productivity of oilseeds led to tremendous increase in prices of oilseeds and edible oils. The increased rate of consumption coupled with geometrically increased population will exalt the dimension of oil deficit problems (Acharya, 1989). Our annual per capita consumption of oils and fats remained only 14.8 kg as against 41 kg in developed countries and 26 kg world average (Hegde 2012). The oil seeds scenario of India has undergone drastic change in recent years due to various incentives and institutional support given by the government for development of this sector. After Technology Mission on Oilseeds (T.M.O.) between 1985- 86 and 1996-1997 area under oilseeds was increased from 19.0 to 26.21 million ha, production increased from 10.83 to 24.96 MT, productivity increased from 570 to 931 kg ha-1 and the level of self-sufficiency increased from 69 to 87 per cent. Niger (Guizotia abyssinica Cass) is an important oilseed crop of India confined mostly to tribal areas. It is extensively grown as a mixed crop with millets or pulse crops or as a sole crop in marginal and sub-marginal lands on hill slopes with very shallow soil. Comparatively high yields are obtained in well drained loam soils of good depth. The crop can also be grown on well drained heavy soil. The low productivity (300 kg ha-1) of Niger in Maharashtra may be due to niger crop is mostly grown on the light soils. The niger plant has an extremely low harvest index. Niger crop genotypes having low yielding ability. There is lack of information regarding optimum spacing, fertilizer dose, fertilizer sources, irrigation, weed and pest–disease management etc. By considering all these point an experiment was conducted as entitled "Studies on growth, yield and quality of niger (Guizotia abyssinica Cass) as influenced by graded levels of fertilizer and plant density" at Experimental Farm, Agronomy Section, College of Agriculture, Latur during kharif 2017-18.

Materials and Methods

A field experiment was conducted during 2017-18 in *rabi* season at Farm of Agronomy Section, College of Agriculture, Latur Geographically Latur is situated between 18^0 05' to 18^0 75' North latitude and between 76^0 25' to 77^0 25' East longitude. It's height from Mean Sea Level is about 540.63 m and has sub-tropical climate. The experimental soil was medium black with initial soil fertility of alkaline in nature (P^H 8.0) containing low in available nitrogen (188.8 kg ha^{-1}), available phosphorus (14.82 kg ha^{-1}) and high in available potassium (588.72 kg ha^{-1}). The experiment was laid out for variety of niger PNS-6 in Factorial Randomised Block Design (FRBD) with 12 treatment combinations consisting of two factors in that three fertilizer grades (NPK kg ha-1) of F1 - 30:15:00, F2 -40:20:00 and F3 -50:25:00 and four spacing (cm) S1 -30x10, S2 -30x15, S3 -45x10 and S4 -45x15 were replicated thrice. The recommended dose of fertilizer (RDF) was as per the treatment. A half dose of nitrogen along with full dose of phosphorus was applied at the time of sowing and remaining half dose of nitrogen was applied 30 DAS. The crop was sown at different spacing and gross plot size was (5.4 X 4.2 m^2 the source of nutrient were Diammonium phosphate (DAP) and Urea.

Results and Discussion

Growth and attributes

The data in respect of mean plant height, number of functional leaves, mean leaf area, number of branches, dry matter, mean, number of flower buds and seed yield. Were influenced by different treatments was recorded periodically during the crop growth stages and presented in table no. 1.

The data presented in table no. 1 is revealed that the growth attributes of sunflower influenced by the application of 50:25:00 NPK grade kg ha^{-1}, to the niger crop were recorded significantly higher plant height (75.46 cm), number of functional leaves (78.94), mean leaf area (34.81 dm^2), number of branches (12.92), dry matter (31.22 g $plant^{-1}$), mean number of flower buds (77.43 $plant^{-1}$) and seed yield (340 kg ha^{-1}), which was at par with the treatment of f2 (40:20:00 NPK kg ha^{-1}) for all above growth attributing characters. Meanwhile the treatments of application of fertilizer grade 30:15:00 NPK kg ha^{-1} was showed superior over the rest of the treatments. The maximum growth and yield of Niger crop is leads due to high grade of fertilizers (50:25:00 NPK kg ha^{-1}) and well response to the spacing.

Effect of Spacing

The growth attributing character of niger crop was significantly influenced by different spacing, the spacing 30 x 10 cm recorded higher plant height (76.84 cm) and at par with the spacing 30 x 15 cm. for spacing 45 x 15 cm, the maximum number of functional leaves (83.39 cm), mean leaf area (38.99 dm^2), number of branches (13.49) dry matter (32.68) g $plant^{-1}$, mean number of flower buds (88.96) $plant^{-1}$, and seed yield (388) kg ha^{-1} and found at par with the spacing 30 x 10 cm and recorded significantly superior over the rest of treatments.

Table 1: Growth studies of Niger as influenced by different treatments

Treatment	Plant height (cm)	No. of functional leaves	Mean leaf Area (dm^2)	No. of Branches he'	Dry Matter (g/plant)	Mean no. of flower buds / plant	Seed yield Kg / ha
(A) Fertilizer grades (kg/ha)							
F1- 30:15:00	66.93	70.02	30.38	11.55	27.25	69.42	270
F2- 40:20:00	74.33	78.21	34.47	12.80	30.90	77.23	320
F3- 50:25:00	75.46	78.94	34.81	12.92	31.21	77.43	340
S.E.+	1.58	1.58	1.05	0.37	0.87	2.29	10.1
C.D. at 5%	4.64	4.65	3.09	1.08	2.55	6.90	29.5
(B) Spacing (S)							
S1- 30 x 10 cm	76.84	65.23	26.65	11.47	27.36	62.18	361
S2- 30 x 15 cm	73.03	78.41	33.83	12.64	29.71	73.96	388
S3- 45 x 10 cm	70.56	71.86	33.41	12.09	29.40	73.69	291
S4- 45 x 15 cm	68.52	83.39	38.99	13.49	32.68	88.96	201
S.E.+	1.83	1.85	1.22	0.43	1.01	2.64	11.6
C.D. at 5%	5.36	5.37	3.57	1.25	2.95	7.74	34.1
(D) Interactions (4)							
S.E.+	3.17	3.17	2.11	0.75	1.74	4.6	20.1
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS
General Mean	72.29	75.72	33.22	12.42	29.79	74.69	310

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