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Influence of Establishment Methods on Growth, Yield and Economics of Niger (*Guizotia abyssinica* Cass.) under *Konkan* Condition

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Abstract: *The experiment was conducted at Agronomy farm, college of agriculture, Dapoli, Dist. Ratnagiri during kharif, 2013, to study the influence of sowing time on growth and yield of Niger (Guizotia abyssinica Cass.) under konkan condition. The present investigation was carried out in a strip plot design with three replications. The main plot treatments comprised of four sowing times viz., 7th June (23rd MW), 21st June (25th MW), 5th July (27th MW) and 22nd July (29th MW) and sub-plot treatments constituted three methods of sowing Viz., Broadcasting, Drilling at 30 cm and Dibbling at 30 x 10 cm. Thus, there were in all twelve (12) treatment combinations. The gross plot size was 4.2 m x 3.2 m and net plot size was 3.6 m x 3.0 m, respectively. Results reveals that the, Dibbling (M_3) method of crop establishment significantly increased the growth and development parameters of niger (except plant height and number of functional leaves plant^{-1}) such as, number of branches sq m^{-1} (588.31), dry matter accumulation sq m^{-1} (1296.47 g), as compared to drilling (M_2) and broadcasting (M_1). Among different establishment methods, drilling recorded significantly higher seed yield and stalk yield ha^{-1} over broadcasting and dibbling. The increased in seed yield recorded by drilling over broadcasting and dibbling was 39.7 and 12.2 per cent, respectively. Similarly, the increased in stalk yield recorded by drilling over broadcasting and dibbling was 35.3 and 12.0 per cent, respectively.*

Key words : *Niger, establishment methods, growth attributes, yield and economics*

INTRODUCTION

Niger (*Guizotia abyssinica* Cass.) is an important traditional oilseed crop cultivated mainly in Ethiopia and India. It is recognized by various names like Noog in Ethiopia and *Ramtil, Kalatil, Khurasani, Karala*, etc. in India. It is considered as minor oilseed crop but it is very important in terms of its oil content, quality and potentiality. Niger seeds contain around 40 per cent oil and about 20 per cent protein. Niger seed oil contains linoleic acid as the primary fatty acid (75-80%), followed by palmitic and stearic acids (7-8%) and oleic acid (5-8%), although Indian Niger oil is reported higher in oleic acid (25%) and lower in linoleic acid (55%). Described as having a "nutty taste and a pleasant odour," the edible oil is the main product from Niger seed in both Ethiopia and India (Burnette, 2010). India is considered to the major niger producing country in the World with an area of 3.64 lakh hectares with the production of 0.98 lakh tonnes and average seed yields is 269 kg ha^{-1} when grown in pure stands (Anonymous, 2011). The major niger growing states are, Madhya Pradesh, Orissa, Maharashtra, Karnataka, Bihar, Andhra Pradesh and West Bengal.

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growing states are, Madhya Pradesh, Orissa, Maharashtra, Karnataka, Bihar, Andhra Pradesh and West Bengal. In Maharashtra, niger is grown over an area of 0.37 lakh hectares with annual production of 0.12 lakh tonnes and the seed yield 324 kg ha^{-1}. (Anonymous, 2011). The major niger growing districts in Maharashtra are Nashik, Osmanabad, Latur, Nanded, Beed, Kolhapur, Pune, Dhule, Ratnagiri and Thane. The choice of establishment methods were identified as important management options to optimise yield of crop. In *Konkan* region of Maharashtra with high rainfall and undulating topography, it is cultivated on very light soils on hill slopes where other crops cannot be grown successfully. Thus, it is a most neglected crop raised under very poor management. The full yield potential of individual plants is achieved when crop sown at wider spacing. When crop sown with closer distance competition among plants were observed resulted in reduction in final yield of crop. Yield of the crop is primarily depend when it subjected to severe competition. Niger is traditionally grown by broadcasting method on tilled land.

MATERIAL AND METHODS

The field investigation was carried out during *kharif*, 2013 at Agronomy farm, college of agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri (MH) situated in subtropical region at 17^0 45′ North latitude and 73^o 1′ East longitude having altitude of 250 meters from Mean Sea Level. The mean annual precipitation at Dapoli is 4700 mm. The soil of experimental plot was sandy clay loam in texture, low in available nitrogen (265.18 kg ha^{-1}) and phosphorus (11.25 kg ha^{-1}), moderately high in available potassium (245.63 kg ha^{-1}), very high in organic carbon (0.97 %) and slightly acidic in nature (pH 5.64). The present investigation was carried out in a strip plot design. The main plot treatments comprised of four sowing times (23^{rd} MW, 25^{th} MW, 27^{th} MW and 29^{th} MW) and sub-plot treatments constituted three methods of sowing (Broadcasting, Drilling with 30cm and Dibbling with 30cm x 10cm). Thus, there were in all twelve (12) treatment combinations. The gross plot size was 4.2 m x 3.2 m and net plot size was 3.6 m x 3.0 m, respectively. Seed bed for the experimental crop was prepared by ploughing the land with tractor drawn plough, followed by one operation by tractor drawn rotavator for clod crushing.

The seeds were sown with broadcast method, drilling (Row spacing 30 cm) and dibbling (30 cm x 10 cm) by using the seed rate 8 kg ha^{-1}, 6 kg ha^{-1} and 4 kg ha^{-1}, respectively, with the help of manual labour and covered properly with soil. One hand weeding was carried out at 30 DAS to keep the crop free from weed competition for growth resources. In order to avoid water stagnation in the field, the channels were prepared to drained out excess water. The experimental crop was harvested when the seeds in the capitulum matured and turned black in colour. Only the net plots were harvested after removing guard lines and observation plants (5 plants/ plot). The harvesting was carried out manually with the help of sickles. The harvested material was kept in the field for two days for sun drying. Later it was threshed manually by beating the harvested material with wooden sticks and seeds were separated. The threshed product was winnowed and cleaned immediately and then the grain and stalk weights were recorded. The economics of growing niger was worked out by considering the prevailing market rates for different inputs and produces and B:C ratio was work calculated.

RESULTS AND DISCUSSION

Growth attributes

Results reveals that the, Dibbling (M_3) method of crop establishment significantly increased the growth and development parameters of niger (except plant height and number of functional leaves $plant^{-1}$) such as, number of branches sq m^{-1} (588.31), dry matter accumulation sq m^{-1} (1296.47 g), as compared to drilling (M_2) and broadcasting (M_1).

However, broadcasting (M_1) method significantly increased the plant height (163.16 cm) non-uniformly over dibbling due to the overcrowding of plants and competition for nutrients and light but, did not differ significantly with drilling (M_2) in respect of plant height at all growth stages of the crop. The increased growth

Table 1
Growth attributes of niger influenced by different establishment methods

Treatments	Plant population (sq m^{-1})	Plant height (cm)	Number of leaves $plant^{-1}$	Number of branches sq m^{-1}	Dry matter accumulation sq m^{-1}
Establishment methods					
M_1- Broadcasting	66.13	163.16	14.60	436.99	972.99
M_2- Drilling	61.05	159.30	16.95	522.13	1041.59
M_3- Dibbling	57.94	152.37	16.14	588.31	1296.47
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.
S.E. ±	1.06	1.99	0.32	8.15	28.80
C.D. at 5%	3.26	6.14	0.99	25.10	88.75

parameters may be attributed to the fact that crop responded better to dibbling rather than broadcasting and drilling in respect of growth and development parameters of niger. This over all resulted in greater productivity of each plant as is evident from the data with respect to dry matter accumulation sq m^{-1}.

High dry matter accumulation in dibbling may be traced to the significant increase in morphological parameters which were responsible for the more photosynthetic capacity of the plant causes more photosynthates. The increased in various growth observations *viz.,* number of branches sq m^{-1} and dry matter accumulation sq m^{-1} ultimately affect on food material production. These results are in agreement with the results reported by Priya *et al.* (2007) and Oraoan *et al.* (2010).

Yield attributes and yield

It is evident from the data regarding to the yield attributing characters of niger indicated that the method of sowing had significantly influence on all the characters except test weight. Dibbling (M_3) recorded significantly higher values of all the yield attributing characters *viz.,* number of capitula sq m^{-1} (1956.91), weight of capitula sq m^{-1} (223.57 g), number of seeds $capitulum^{-1}$ (24.35) over broadcasting (M_1) but at par with drilling (M_2) (Table 2). Drilling recorded significantly higher seed yield q ha^{-1} (2.74 g), stalk yield q ha^{-1} (15.04 g), and total dry matter sq m^{-1} (177.79 g) over broadcasting and dibbling. The increased in seed yield recorded by drilling over broadcasting and dibbling was 39.7 and 12.2 per cent, respectively. Similarly, the increased in stalk yield recorded by drilling over broadcasting and dibbling was 35.3 and 12.0 per cent, respectively. These results are in agreement with the observations made by Talathi *et al*. (2007), Dhadge *et al.* (2008), Kausik Mandal and Saren (2012).

The data revealed that the dibbling method of establishment significantly improved the yield

Table 2
Yield and yield attributes of niger influenced by different establishment methods

Treatments	No. of capitula sq. m^{-1}	No. of seeds $capitulum^{-1}$	1000-seed weight (g)	Seed yield (g) sq. m^{-1}	Seed yield (q ha^{-1})	Stalk yield (q ha^{-1})	Total dry matter (g) sq. m^{-1}
Establishment methods							
M_1- Broadcasting	1432.92	18.68	3.35	19.63	2.43	13.22	130.70
M_2- Drilling	1865.28	22.78	3.48	27.19	2.88	15.24	177.79
M_3- Dibbling	1956.91	24.35	3.41	24.69	2.27	12.71	158.61
'F' test	Sig.	Sig.	N.S.	Sig.	1.95	11.58	Sig.
S.E. ±	36.21	0.49	0.04	0.89	Sig.	Sig.	3.03
C.D. at 5%	111.59	1.52	-	2.74	0.08	0.36	9.34

attributes but, did not reflect the seed and stalk yield as substantially due to the decreased in plant population sq m^{-1} as compared to drilling. However, drilling found significantly improved the seed and stalk yield ha^{-1} as compared to dibbling due to the increased in number of plants sq m^{-1} over broadcasting also.

Results pertaining to seed yield and stalk yield indicated that the seed yield, stalk yield and total dry matter production of niger were the highest in drilling method and significantly superior over broadcasting and dibbling. The favourable influence of drilling on increasing the yield contributory characters almost near to the dibbling or sink characters provided evidence for provided greater seed yield over broadcasting and dibbling.

Economics

Drilling of niger gave the highest gross return (Rs. 22205.67), net returns (Rs. 6645.22) and B:C ratio (1.42) over broadcasting and dibbling (Table 3). Among all these establishment methods drilling was found to be economically most profitable. The B:C ratios recorded under broadcasting and dibbling were 1.11 and 1.19, respectively. The increased gross return, net returns and benefit cost ratio were mainly due to increased seed and stalk yield of niger under drilling over rest of the establishment methods. Similar findings were also recorded by Oraoan *et al.* (2010) and Kausik Mandal and Saren B. K. (2012).

Table 3
Yield and economics of niger influenced by different establishment methods

Treatments	*Seed yield (q ha-1)*	*Stalk yield (q ha-1)*	*Cost of cultivation (₹ ha-1)*	*Net returns (₹ ha-1)*	*B : C Ratio*
Establishment methods					
M1- Broadcasting	1.96	11.11	14261.78	1702.89	1.11
M2- Drilling	2.74	15.04	15560.44	6645.22	1.42
M3- Dibbling	2.44	13.42	16549.75	3242.75	1.19
S.E. ±	0.09	0.24	-	-	-
C.D. at 5%	0.27	0.75	-	-	-

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