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Effect of soil moisture conservation practices and planting pattern on growth and yield of niger (*Guizotia abyssinica* L. Cass.)

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ABSTRACT
A field experiment was conducted during kharif 2018 at Experiment Farm, Agronomy section, College of Agriculture, Latur to study the effect of soil moisture conservation practices and planting pattern on growth, yield and quality of niger (Guizotia abyssinica L. Cass.).Paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t/ha (T_8) recorded higher values of growth characters viz., plant height (cm), number of branches plant^{-1}, number of functional leaves plant^{-1}, leaf area plant^{-1} (dm^2), dry matter plant^{-1} (g), number of flower heads plant^{-1}. The yield parameters like number of seeds per flower head, seed yield plant^{-1} (g), weight of mature flower heads plant^{-1} (g), test weight (g), seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}), harvest index (%)showed higher values due to paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t/ha (T_8).
Keywords *–Mulching, Planting patterns, Soil moisture, Niger.*

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INRODUCTION

Niger (*Guizotia abyssinica* L. Cass.) is one of the important oilseed crop of India belonging to family compositae. India is a major niger growing country accounting for more than 50 per cent of world niger area and production. Madhya Pradesh, Bihar, Maharashtra, Odisha, Karnataka and Tamil Nadu are the major niger producing states. Niger has low response to nitrogen and phosphorus fertilizer. However, a rate of 40 kg N ha^{-1} and 20 kg P_2O_5 ha^{-1} is necessary for stand establishment. India is the largest producer of niger in the world which was grown over an area of 2.52 lakh ha with a production of 0.74 lakh tones and productivity of 295 kg ha^{-1} reported by Anonymous [2].

Being an agriculture country India should have a good respect towards conservation strategies especially of water. Everyday soil moisture is also lost in various ways by evaporation from the soil, through deep percolation below the root zone, transpiration by sprouting weeds and so on. So, conserving soil moisture is a great and most important deal now a day especially through agricultural aspects. Soil moisture conservation by mulching is one of the most significant practices in rained agriculture. Mulching not only checks evaporation but it also reduces the soil degradation through reducing the runoff and soil loss and minimizes the weed infestation. It increases soil water retention capacity and controls soil temperature fluctuations. Mulching adds organic matter and nutrients to the soil and improves the physical, chemical and biological properties of soil resulted in increase in growth and yield of crops. Under rainfed situation, mulching increased yield by 50-60 per cent over without mulched treatment reported by Patil *et al*., [7]. Straw mulching usually decreases the day time soil temperature and retains the heat during night and thus help in increasing residual soil moisture reported by Bragagnolo and Mielniczuk [3].

Planting pattern is an important agronomic factor that manipulates micro environment of field and affects growth, development and yield of crop. Plant spacing determines the canopy structure which affect the crop in two important ways, first through light interception and distribution, secondly, through correlated physiological development and morphological changes. Plant spacing varies from one plant species to another and thus, must strictly be controlled to prevent over-crowding which may in turn affect growth and development of crops. It is observed that adequate spacing of crop is important for good yield.

MATERIAL AND METHODS

A field experiment was conducted during *kharif* 2018 at Experiment Farm, Agronomy section, College of Agriculture, Latur. The experimental field was levelled and well drained. The soil was clayey in texture, very low in nitrogen (134.81 kg ha^{-1}), medium in phosphorus (20.27 kg ha^{-1}) and very high in potassium (436 kg ha^{-1}) with slightly alkaline reaction (pH 8.1). The environmental conditions prevailed during experimental period was not much favourable for normal growth and development of niger crop. The longer dry spell of rainfall was occurred during the reproductive stage of the crop and affect the seed yield.

The experiment was laid out in Randomized Block Design with eight treatments replicated thrice. The treatments were T_1- Control, T_2- Dust mulching (2 hoeings), T_3- Straw mulching (2.5 t/ha), T_4- Opening of alternate furrow (30 DAS), T_5- Paired row planting (30-60 cm × 15 cm), T_6- Paired row planting with opening of alternate furrow (30 DAS), T_7- T_5 + dust mulching and T_8- T_5+ straw mulching. The gross and net plot size of each experimental unit was 5.4 m x 4.2 m and variable, respectively. Sowing was done by dibbling method on 11th July 2018. The recommended dose of fertilizer was applied to all the plots at the time of sowing. The recommended cultural practices as per the treatments and plant protection measures were undertaken. The crop was harvested on 7th Oct, 2018.

RESULT AND DISCUSSION

Growth and growth attributes

The data presented in Table No.1 revealed that the growth attributes *viz*., plant height, number of branches $plant^{-1}$, leaf area $plant^{-1}$ (dm^2), dry matter accumulation $plant^{-1}$ (g)and number of flower heads $plant^{-1}$were influenced significantly due to different soil moisture conservation practices and planting patterns. Paired row planting of 30-60 cm × 15 cm with straw mulching @ 2.5 t ha^{-1} (T_8) recorded highest plant height as compared to other treatments at all growth stages of crop. This might be due to more moisture conservation under paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} and efficient utilization of soil moisture resulted in more availability of nutrients in the soluble and available form. These results are in conformity with the results reported by Kar *et al.* [6]).At all growth stages, paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} (T_8) followed by straw mulching @ 2.5 t ha^{-1} (T_3) and opening of alternate furrow at 30 DAS (T_4) recorded highest leaf area $plant^{-1}$(33.04 dm^2). It might be due to more number of leaves with broader size under better moisture conservation practice. These findings were in confirmative with those reported by Ambika *et al.* [1] and Sandeep and Kubsad [8].

Paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1}(T_8) recorded significantly highest number of branches per plant followed by straw mulching @ 2.5 t ha^{-1} (T_3) and opening of alternate furrow at 30 DAS (T_4) at all growth stages of crop than other treatments. This may be because of more moisture conserved and less evaporation due to straw mulching and opening of alternate furrows. Such type of effect of moisture conservation on number of branches per plant was reported by Verma *et al.* (9). Paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} (T_8) produced higher dry matter per plant at all the growth stages which was closely followed by straw mulching @ 2.5 t ha^{-1} (T_3). Higher dry matter was obtained due to the availability of readily available soil moisture for rapid initial growth and cumulative improvement in most of the growth parameters as a result of sustained availability of soil moisture and due to better soil physical conditions during the entire season. This results might be associated with more number of leaves and secondary branches and trapping of more sunlight that enhanced the rate of photosynthesis and resulted much more dry matter production. Such results were reported by Kar *et al.*, (6) and Dodiya *et al.,* (5).The higher number of flower heads per plant was obtained due to paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} (T_8) which was at par with straw mulching @ 2.5 t ha^{-1} (T_3), opening of alternate furrow at 30 DAS (T_4) and paired row planting with opening of alternate furrow at 30 DAS (T_6) at all the growth stages and significantly superior over rest of the treatments. It might be due to better geometric arrangement resulting in better absorption of moisture and nutrient due to lesser competition for growth factors and highest height and more branches. These findings were in confirmative with those reported by Sandeep and Kubsad (8).

Yield attributes and yield

The yield attributing characters *viz*., number of seeds per flower head, seed yield $plant^{-1}$ (g), seed yield (kg ha^{-1}), biological yield (kg ha^{-1}) were influenced significantly due to different soil moisture conservation practices with planting patterns.(Table No.2). Highest number of seeds per flower head was recorded due to paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} (T_8) which was comparable with straw mulching @ 2.5 t ha^{-1} (T_3) and opening of alternate furrow at 30 DAS (T_4). This might be due

to better moisture availability at grain filling stage due to application of straw. Similar results regarding number of seeds per flower head was reported by Dhange *et al.* (4) and Sandeep and Kubsad (8). Paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} (T_8) recorded more seed yield $plant^{-1}$. This might be due to the enhanced vegetative growth and other yield attributes i.e. more flower head $plant^{-1}$. Highest seed yield (587 kg ha^{-1}) was produced due to paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} (T_8) which was closely followed by straw mulching @ 2.5 t ha^{-1} (T_3) (535 kg ha^{-1}) and opening of alternate furrow at 30 DAS (T_4) (523 kg ha^{-1}). This might be due to higher growth and yield contributing characters under more moisture conservation practice which resulted in increasing the final economical yield. The similar results were obtained by Kar *et al*. (6) and Dhange *et al.* (4).The treatment of paired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} (T_8) produced higher biological yield (4282 kg ha^{-1}) which was found significantly superior over T_1, T_2 and T_7. This might be due to higher growth under more moisture conservation by straw mulching and more space for infiltration of rain water in between two paired rows.Weight of mature flower heads per plant (g), test weight (g) and harvest index (%) were not influenced significantly due to various treatments.
From the above discussion it may be concluded that the treatment ofpaired row planting (30-60 cm × 15 cm) with straw mulching @ 2.5 t ha^{-1} (T_8) were found beneficial in improving yield of niger crop.

Table 1. **Plant height, number of branches $plant^{-1}$, leaf area $plant^{-1}$, dry matter $plant^{-1}$, number of flower heads $plant^{-1}$ as influenced by various treatments.**

Treatment details	Plant height (cm)	No. of branches $plant^{-1}$	Leaf area $plant^{-1}$ (dm^2)	Dry matter $plant^{-1}$ (g)	Number of flower heads $plant^{-1}$ (g)
T_1- Control	81.90	11.13	3.54	24.99	79.13
T_2- Dust mulching (2 hoeing's)	92.57	11.50	4.23	26.50	83.37
T_3- Straw mulching (2.5 t/ha)	103.56	12.77	6.83	29.15	98.13
T_4- Opening of alternate furrow (30 DAS)	102.87	12.40	5.81	27.91	96.50
T_5- Paired row planting (30-60cm ×15cm)	94.93	11.93	4.71	27.60	91.17
T_6- Paired row planting with opening of alternate furrow (30 DAS)	102.37	12.30	5.11	27.68	94.30
T_7- T_5 + dust mulching	94.88	11.60	4.57	27.41	83.43
T_8- T_5 + straw mulching	106.13	12.93	7.45	31.51	100.03
SE±	3.33	0.37	0.35	1.13	2.68
C.D. at 5%	10.09	1.14	1.05	3.44	8.13
General Mean	**97.40**	**12.07**	**5.28**	**27.84**	**90.76**

***A.H- At harvest**

Table 2.Effect of Number of seeds per flower head, Seed yield $plant^{-1}$, Seed yield (kg ha^{-1}) and Harvest index (%) on yield attributing characters

Treatments	Number of seeds per flower head	Seed yield $plant^{-1}$ (g)	Seed yield (kg ha^{-1})	Harvest index (%)
T_1- Control	15.14	3.5	341	10.55
T_2- Dust mulching (2 hoeing's)	15.40	4.7	450	12.50
T_3- Straw mulching (2.5 t/ha)	18.35	5.6	535	13.43
T_4- Opening of alternate furrow (30 DAS)	17.91	5.3	523	13.27
T_5- Paired row planting (30-60cm ×15cm)	16.61	5.1	509	13.03
T_6- Paired row planting with opening of alternate furrow (30 DAS)	17.49	5.3	521	13.26
T_7- T_5 + dust mulching	16.44	4.8	503	13.02
T_8- T_5 + straw mulching	18.75	5.8	587	13.71
SE±	0.68	0.22	22	--
C.D. at 5%	2.05	0.67	67	--
General Mean	**17.01**	**5.0**	**496**	**12.85**

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