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EFFECT OF NUTRITION LEVEL ON SESAMUM (*SESAMUM INDICUM* L.) VARIETIES UNDER RAINFED CONDITION

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Abstract

An experiment was conducted during Kharif 2017 in a micro-plot at Department of Crop Physiology C.S. Azad University of Agri. & Tech. Kanpur-2, Uttar Pradesh, (India). Complete Randomized Block Design was used in the trial. Aimed with to study the effect of Nitrogen, Phosphorus, Potassium Sulphur, and Farm Yard Manure used in the experiment were 40:20:20:20 and 2.5 t/ha. Significantly increased growth yield and quality of Sesamum varieties Shekhar (V1), Pragati (V2), and Tarun (V3) and treatment as control(NPK) T1, NPK+S (T2), NPK+FYM(T3) and NPK+S+FYM@ 40:20:20:20kg /ha and 2.5 t/ha. (T4). Result revealed that the application of T4(Nitrogen, Phosphorus, Potassium, Sulphur, and Farm Yard Manure) and variety Tarun overall best response in all observation like as used in the experiment were Significantly increased as growth observation Plant height different growth stages (cm), Leaf area plant^{-1}(cm^2), as metabolic activity Chlorophyll intensity (%) and yield attributes Number of capsule plant^{-1}, Total dry weight plant^{-1}, Number of grains capsule^{-1}, Biological yield plant^{-1} (kg/ha), Grain yield (kg/ha) were significantly enhanced in comparison to control (NPK).

Key words: Sesamum, Nitrogen, Phosphorus, Potassium, Sulphur and Farm Yard Manure, grain yield, growth indices and yield components.

Introduction

Sesamum grains are a rich source of food, nutrition, edible oil, and biomedicine. Sesamum oil has excellent nutritional, medicinal, cosmetic and cooking qualities for which is known as 'the queen of oil grains'. Due to the presence of potent antioxidants, sesamum grains are called as 'the grains of immortality'. Sesamum cake or meal obtained as a byproduct of the oil milling industry is rich in protein, vitamin (Niacin) and minerals (Ca and P). The world's largest exporter of sesamum grains was India. Japan was the largest importer because they use sesamum grain in bakery industry (FAO, 2012). India ranks first in both acreage and production (about 8 lakh MT) of sesamum in the world (The Statistics Portal).

The crop is grown for its grains, which contain 50-60% oil, 8% protein, 5.8%water, 3.2% crude fiber, 18% carbohydrate, 5.7% ash and it is very rich in minerals such as Ca, P and vitamin E. Also, sesamum oil has a very high level of unsaturated fatty acids, which is assumed to have a reducing effect on plasma cholesterol, as well as on coronary heart disease. Effects of nitrogen fertilization on oil composition and quality are inconsistent. Nitrogen being a major food for plants is an essential constituent of protein (build from amino acids that involve in catalyzation of chemical responses and transportation of electrons) and chlorophyll (enable the process of photosynthesis) present in many major portions of the plant body. Nitrogen plays a most important role in various physiological processes. It imparts dark-green color in plants, promotes leaves, stem and other vegetative part's growth and development. Moreover, it also stimulates root growth. Nitrogen produces rapid early growth, improve fruit quality, enhances the growth of leafy vegetables, increases the protein content of fodder crops; It encourages the uptake and utilization of other nutrients including potassium, phosphorous and controls overall growth of the plant. N increases the vegetative growth but delayed maturity of grain yielding plants and excessive use of this element may produce too much of vegetative growth, thus food production may be impaired and suggesting that N management is crucial in the cropping system and for normal plant growth and development (Maini *et al*., 1959 and Singh *et al*., 1972). However, to my knowledge little is known whether different doses of N along with different doses of sulfur, FYM regulate the growth, yield of sesame using new variety. The study suggests predictable benefits to crop production and yield from FYM application to agricultural desert land.

Materials and Method

Experimental Soil: The soil used for filling the plots was obtained from the experiment Department of Crop Physiology at C.S. Azad University of Agriculture and Technology Kanpur, sandy loam soil was used for experimental purposes. The soil was analysis chemically by taking lots of soil sample from various places randomly, mixing and making a composite sample. The soil was analysed before application of fertilizers to the plots.

Plant height prior to heading, this was measured from the lowest node at the base of the plant to the end of the fully unfurled top leaf, after flowering the upper limit fixed for this measurement was the base of the ear. Leaf area per plant Leaf area per plant (dm^2) was measured by taking length and width of each leaf multiply with the factor 0.709 (Rao et al., 1990) and number of leaves. Then averaging and converted on plant basis. **Chlorophyll intensity (%)** Chlorophyll intensity (%) was measured by SPAD 502 PLUS. **Number of Capsules**

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plant-^{1} The number of capsuless obtained from each plant were recorded ingrams. **Dry weight plant-^{1}** The plant sample different growth stage indicted earlier, were utilized for recorded the data on total dry weight per plant (**g**) at corresponding stages of growth. **Grain yield (kg ha^{-1})** at maturity, the sesamum crop in each plot was harvested and threshed and yield ha^{-1} was calculated by the following formula (Nadeem *et al.,* 2015).

Preparation of field and Basal Manuring: The experimental field was ploughed once with a soil turning plough by harrow and two ploughings with Desi plough. Finally, it was planked to give a uniform level. A Basal manuring of 20 Kg N, 20 Kg P_2O_5, 20 Kg K, 20 kg S and FYM 2.5 tons/ha was applied uniformly in the form of urea, DAP, muriate of potash and sulphate. Another dose of 20Kg N/ha in the form of urea was applied after first irrigation i.e. one month after sowing, The sowing was done in plot with row to row cm and depth 5cm below.

Treatment and layout: The experiment was conducted in Randomized Block Design with twelve treatment and three replications. Grain of three promising Sesamum genotype of comparatively wider adaptability *viz*., Shekher (V_1), Pragati (V_2), and Tarun (V_3) and treatment combination T_1- control NPK, T_2- NPK+S, T_3- NPK+S+FYM and T_4 @40:20:20 kg/ha + S @20 kg/ha were used in this experiment. Pure grains of these genotypes were obtained from the Economic Botanist (Oilgrain) of this University.

Results

The data on plant height affected Nutrition level, at various crop growth days of sesame is presented in table 1 plant height increased continuously from 25 days till at harvest. The increase was more between first to third intervals as compared to third and fourth.The data presented that a general increase in the length of plant height as the increase in the time of days. The variety Tarun significantly by higher followed by Pragati and it is also higher produce followed by Shekhar. Among over all these traits given treatments (T1, T2, T3, T4) applied on plants however, the data significantly positively higher T4 and variety Tarun (V3). At 60-65 DAS, the maximum plant height (97.51 cm) was achieved in NPK+S and FYM (@40:20:20:20 kg/ha and 2.5 t/ha) and significantly superior over to control. NPK+S and FYM (@40:20:20:20 kg/ha and 2.5 t/ha) found better than others. However, minimum plant height (80.71cm) was recorded in control. Rest treatments found significantly superior against control. At 80-85 DAS, the maximum plant height (98.77cm) was achieved in Nutrition level NPK+S and FYM (@40:20:20:20 kg/ha and 2.5 t/ha) and significantly superior over to control. Nutrition level NPK+S and FYM (@40:20:20:20 kg/ha and 2.5 t/ha) found better than others. However, minimum plant height (23.78cm) was recorded in the control. Rest treatments found significantly superior against control. Maximum plant height 80-85 DAS was recorded in T_4(95.59cm), minimum in control (84.45 cm), V_3 (94.03cm) in comparison to other variety (87.44 and 90.54cm).

Leaf area index plant^{-1} (cm^2): Data displayed in table 2 regarding leaf area index plant^{-1} showed that leaf area index value continuously rose from 0.92 to 2.75 *i.e.* 40-45 DAS to 60-65 DAS. Effect of Nutrition level NPK+S and FYM(@40:20:20:20 kg/ha and 2.5 t/ha), on sesamum crop improved significantly. Individually consideration of 40-45 DAS, all treatments produced significant superior values against control plants. Maximum leaf area index (2.26) was recorded in Nutrition level NPK+S and FYM (@40:20:20:20 kg/ha and 2.5 t/ha). FYM has significant response in comparison with control plant and also differed from each other of treatments. At 60-65 DAS, leaf area index value increased from 40-45 DAS. Overall similar trend was noted and significantly highest value of leaf area index 2.75 was registered in Nutrition level NPK+S and FYM(@40:20:20:20 kg/ha and 2.5 t/ha).and minimum leaf area index in control plant (1.66).

Chlorophyll Intensity (%): A critical study on the table-3 revealed that chlorophyll Intensity of sesamum plant up to 60-65 DAS and decreased from 80-85 DAS. Individually, at 60-65 DAS, maximum intensity (68%) was observed in Nutrition level NPK+S and FYM(@40:20:20:20 kg/ha and 2.5 t/ha) while lowest intensity was (47.45%) in control. It was also true, Nutrition level NPK+S and FYM(@40:20:20:20 kg/ha and 2.5 t/ha) both also produced similar chlorophyll Intensity.

As days advanced of crop, the average value of chlorophyll Intensity (%) appreciated from 68.00% to 47.45% and similar response of trend was recognized as previous data. Nutrition level NPK+S and FYM (@ 40:20:20:20 kg/ha and 2.5 t/ha) possessed highest chlorophyll Intensity 68.00% followed control NPK(@40:20:20 kg/ha) were statistically at par with each other, but significantly superior higher chlorophyll Intensity values.

Number of capsule plant^{-1}: On an average 33.96 capsule plant^{-1}table 4 was recorded under affected of nutrition level NPK+S and FYM (@40:20:20:20 kg/ha and 2.5 t/ha) of sesamum crop. Maximum capsule plant^{-1} (36.32) was recorded under nutrition level NPK+S and FYM(@ 40:20:20:20 kg/ha and 2.5 t/ha). However, nutrition level FYM(@ 40:20:20:20 kg/ha and 2.5 t/ha) had statistically similar effect on number of capsule but significantly more number of capsules plant^{-1} against control.

Total dry weight plant^{-1}(g): It is perceived from the table 5 that dry weight of the plant continuously increased from first observation to maturity. There is sharp enhancement in the 60-65 DAS to at maturity. Effect of Nutrition level NPK+S and FYM(@40:20:20:20 kg/ha and 2.5 t/ha)also significantly observed. Regarding 80-85 DAS, maximum dry matter was obtained by the application of Nutrition level NPK+S and FYM(@40:20:20:20 kg/ha and 2.5 t/ha). Lowest dry matter was recorded in control while NPK(@40:20:20 kg/ha) both were statistically at par with control in dry matter. At 80-85 DAS, there was sharp rise in dry weight of plant from 60-65 DAS to 40-45 DAS. As previous stage Nutrition level NPK+S and FYM(@40:20:20:20 kg/ha and 2.5 t/ha)also achieved maximum dry weight (28.53) in comparison to control plant dry weight (26.35). Furthermore, among the remain treatment also obtained significant more dry weight.

Grain yield (Kg ha^{-1}): A thorough study of the table 6 grain yield per ha.was revealed that the affected of mineral nutrient and growth regulators was significant against control. Considering individual effect of nutrition level and urea showed that both yielded significantly more grain yield per plant in comparison to control and the difference of grain weight between these two treatments were significant. Further thiourea and zinc + urea also gave significantly more grain weight than control. While among them, the difference was also significant. Hence, all treatments were produced more grain weight plant^{-1}.

Discussion

Thus the present investigation is aimed to study the effect of physio-morphological parameters for sesamum in breeds to identify the physiological efficient inbreeds lines of sesamum for conclusion in hybrid development programme. The results which have been described earlier have been briefly discussed here in the light of available literature. The extent of variability in sesamum genotypes observed in present studies has been summarized in tables considering the above for the study on various physiological parameters disputes in the height of data lecture available.

The height of plant at 25 DAS varied from Shekhar (23.78cm) Pragati (24.57cm) and Tarun (25.81cm) in at this stage maturity of lines producing maximum plant height where due to inherent ability of genotypes. It self-quantity stored food present in the grain. In grain which boost up the seedling for stand as advancement in crop duration *i.e.* 45 DAS variety Tarun produce maximum plant height 74.12cm followed by Pragati and the minimum plant height variety Shekhar where the genotype which obtained minimum plant height this stages at 65 DAS, the time of harvest sesamum variety (98.77cm) followed by Pragati and shekhar.

The Chlorophyll intensity in leaf at vegetative stage (60-65 DAS) varied from (47.45cm), Pragati and Tarun at this stage maturity of lines producing minimum and maximum Chlorophyll intensity in leaf where due to inherent ability of genotypes. It self-quantity stored food present in the grain. In grain which boost up the seedling for stand as advancement in crop duration *i.e.* maturity stage genotypes Tarun produce maximum Chlorophyll intensity in leaf (77.19cm) followed by Pragati and the minimum Chlorophyll intensity in leaf genotype Shekhar, where the genotype which obtained minimum this Chlorophyll intensity in leaf stages at maturity stages genotype.

In case of plant dry weight at the data revealed that at different growth stages *i.e.* 25, 45, 65 and 85 DAS stage are presented positively significant which revealed that at 25 DAS stage all the genotypes showed slow rate of growth in plant weight up to 35 DAS stage after which there was slight triggering up in growth up to 45 DAS. Plant weight at 25 DAS varied significantly among all the test genotypes ranged from 27.84g to 30.38g. Acceleration being maximum inTarun(30.38 g) followed by Pragati (28.76 g) and Shekhar (27.84 g) respectively.

In case of plant dry weight the data revealed that At 45 DAS stage varied significantly among all the test genotypes positive significant of sesamum and ranged from 1.66g to 2.26 g Acceleration being maximum in Tarun(2.26 g) followed by Pragati (2.09g) and Shekhar (1.66g) respectively. At 65 DAS stage also varied significantly among all the genotypes ranged from 2.02 to 2.75 g. Acceleration being maximum in Tarun (2.75g) followed Pragati (2.54g) and Shekhar (2.02g) respectively.

In case of leaf area per plant at different growth stages *i.e.* vegetative stage and maturity stage are high rate of leaves area which revealed that at vegetative stage all the genotypes showed slow rate of growth in leaf area up to maturity stage after which there was slight triggering leaf area up to maturity leaf area of plant. At vegetative stage varied significantly among all the test genotypes of ranged from 1.66 cm to 2.26 cm. Acceleration being maximum in Tarun (2.26cm) followed by Pragati (2.09cm) and Shekhar (1.66cm) respectively. At maturity stage varied significantly among all the test genotypes ranged from 2.02 cm to 2.75 cm. Acceleration being maximum in Tarun (2.75 cm) followed by Pragati (2.54cm) and Shekhar (2.02 cm) respectively.The data indicated in presented that the mean value of total grain yield q/ha genotype maximum production in Tarun (9.45q/ha) and minimum production in shekhar (6.95q/ha) at maturity stage. All the test genotype ranged between 6.95 to 9.45q/ha at the harvesting stage and the data of total grain yield q/ha are significant.

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Table 1: Effect of nutritional level on Plant height (cm) studies of Sesamum (*Sesamum indicum* L.) varieties

DOF / VAR	20-25 DAS					40-45DAS					60-65DAS					80-85DAS				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
V_1	21.95	23.65	24.41	25.12	23.78	61.35	64.78	67.21	69.15	65.62	80.71	85.14	88.42	90.97	86.31	81.75	86.32	89.56	92.14	87.44
V_2	22.85	24.35	25.15	25.95	24.57	63.35	66.80	69.68	71.95	67.94	83.34	87.88	91.67	94.66	89.38	84.41	89.03	92.85	95.88	90.54
V_3	23.45	25.75	26.37	27.68	25.81	65.45	68.88	72.83	74.12	70.32	86.10	90.62	95.15	97.51	92.34	87.21	93.79	96.38	98.77	94.03
Mean	22.75	24.58	25.31	26.25		63.38	66.82	69.90	71.74		83.38	87.88	91.74	94.38		84.45	89.71	92.93	95.59	

Table 2: Effect of nutritional level on Leaf area index studies of sesamum (*Sesamum indicum* L.) varieties

DOF / VAR.	40-45 DAS (LAI)					60-65b DAS (LAI)				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
V1	0.92	1.39	1.58	1.66	1.38	1.12	1.69	1.92	2.02	1.68
V2	1.36	1.83	2.00	2.09	1.82	1.66	2.23	2.43	2.54	2.21
V3	1.53	1.99	2.17	2.26	1.98	1.86	2.42	2.64	2.75	2.41
Mean	1.27	1.73	1.91	2.00		1.54	2.11	2.33	2.43	

Table 3: Effect of nutritional level on Chlorophyll intensity (%) studies of Sesamum (*Sesamum indicum* L.) varieties

DOF / VAR	Chlorophyll intensity (%) 60-65 DAS				
	T_1	T_2	T_3	T_4	Mean
V1	31.45	47.70	53.91	56.77	47.45
V2	46.56	62.49	68.62	71.47	62.28
V3	52.28	68.21	74.33	77.19	68.00
Mean	43.43	59.46	65.62	68.47	

Table 4: Effect of nutritional level on number of capsule per plant studies of Sesamum (*Sesamum indicum* L.) varieties

DOF / VAR.	Number of capsule per plant				
	T_1	T_2	T_3	T_4	Mean
V1	31.75	33.52	34.78	35.79	33.96
V2	32.78	34.58	36.06	37.24	35.16
V3	33.87	35.65	37.43	38.36	36.32
Mean	32.80	34.58	36.09	37.13	

Table 5: Effect of nutritional level on total dry weight per plant (g), of Sesamum (*Sesamum indicum* L.) varieties

DOF / VAR.	Total dry weight plant $^{-1}$(g)				
	T_1	T_2	T_3	T_4	Mean
V1	24.32	26.22	27.04	27.84	26.35
V2	25.31	26.98	27.88	28.76	27.23
V3	25.99	28.52	29.23	30.38	28.53
Mean	25.20	27.24	28.05	28.99	

Table 6: Effect of nutritional level on Grain yield (kg/ha) of Sesamum (*Sesamum indicum* L.) varieties

DOF / VAR.	Grain yield (kg/ha)				
	T_1	T_2	T_3	T_4	Mean
V1	38.50	58.40	66.00	69.50	58.10
V2	57.00	76.50	84.00	87.50	76.20
V3	64.00	83.50	91.00	94.50	83.20
Mean	53.10	72.80	80.30	83.80	