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RESEARCH

ASSESSING THE EFFECT OF GROWTH AND YIELD ATTRIBUTES OF SESAME AT RED LATERITIC ZONE OF WEST BENGAL

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Abstract: A field experiment was conducted at Farmer's field located at Kapgari, Jhargram, West Bengal, India to study the effect of foliar nutrients on summer sesame (sesamum indicum L.) in alluvial soils of West Bengal in the year of 2021. The experiment comprised of 10 different foliar treatments viz. water spray, K2SO4 @ 0.75%, KCl @ 0.75%,KCl @ 0.5%, NaCl @0.5%, NaCl @ 0.75%, N P K 19:19:19 @ 0.5%, N P K 19:19:19 @ 0.75%, N P K 10:26:26 @1.5%, D A P @ 1.5% at 50 % flowering and seed filling stage of sesame crop. The crop was sown on Jul 2021. A recommended dose of fertilizers was applied @ N2: P2O5: K2O -60:30:30 kg/ha in the form of N- P- K 10:26:26. Half nitrogen, full of phosphate and potassium as basal dose, remaining half of N was applied at 25 DAS. The variety of the sesame crop was Tillotoma (B-67). The experiment was conducted in randomized block design with three replications. Foliar nutrients were applied at flowering and seed filling stage of the crop with special reference to scanning their effect on growth and yield of the crop during summer season of 2021. The salient features of the findings were in general, application of spray salts at 50% flowering and seed filling stage recorded better growth and yield attributing characters. Among all the foliar nutrient treatments, significantly higher grain yield was obtained by N P K 19:19:19 @0.15% followed by N:P:K19:19:19 @0.5%. The lowest grain yield was obtained by spraying of water only. It is interesting to note that all the supplementary foliar nutrients enhanced seed yield of sesame significantly over control. Highest seed yield was recorded under the foliar feeding with N P K 19:19:19 (0.75%), and effective capsule per plant recorded by the application N P K(19:19;19)@0.75% followed by N P K (10:26:26) @1.5%. The seeds per capsule was improved by the foliar application N P K (19:19:19) @0.75%. The application of N P K 19:19:19 @ 0.75% was found to be most cost-effective foliar nutrient and D A P @1.5% was found to be second most cost-effective foliar nutrient.

Keywords: Crop, Field experiment, Foliar application, Sesame

INTRODUCTION

Sesame (*Sesamum indicum* L.) is the most important traditional oil crop grown especially in marginal and dry areas during monsoon (Pathak *et al*., 2014). It is one of the oil plants whose oil content varies between 50-60% depending on the variety. Sesame oil contains important antioxidants namely sesamolin and sesamol which prevent rancidity of this oil (Rangkadilok et al., 2010) and its oil is a rich source of essential unsaturated fatty acids such as oleic acid (42%) and linolenic acid (35%) (Uzun *et al*., 2008). In addition, sesame flour contains ash (5.27%), fiber (6.22%) and carbohydrates (28.14%), which are highly nutritious for livestock (Raza *et al*., 2018). Sesame oil has excellent nutritional, medicinal, cosmetic and culinary properties, which is why it is known as the "Queen of Oilseeds". Because of their powerful antioxidants, sesame seeds are called the "seeds of immortality". A member of the Pedaliaceae family, it is considered the oldest oil plant. It is cultivated from tropical to temperate regions including Asia, Africa and South America. The history of cultivation of this crop originates from 5000-5500 years ago in the Harappa Valley in Peninsular India (Bedigian and Harlan, 1986). Sesame is widely cultivated in the world on more than 11.74 million hectares, with an annual production of 6 million tons and a yield of 512.30 kg/ha. Sudan, Myan - March, India, Nigeria, United Republic of Tanzania and mainland China are the largest sesame growing countries in the world. Along with growing health awareness, the international demand and export of sesame is constantly increasing. India naturally has favorable

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weather conditions that support sesame production. In 2018, India ranked third in the world in terms of sesame production (746,000 tons) and area under sesame cultivation (1,730,000 ha). West Bengal, Madhya Pradesh, Rajasthan, Uttar Pradesh, Gujarat, Andhra Pradesh and Telangana Pradesh. West Bengal's production (0.153 million tons) is the highest among all states.

The yield potential of sesame is 2.0 t/ha, but due to poor source and sink, rich stand yields sesame especially in Kharif which leads to poor yield. Adopt appropriate management practices to control plant growth, such as improved varieties, management of fertilizers and other agrochemicals; the efficiency of source and sink allocation can be increased and the yield potential of sesame can be exploited (Harisudan et al., 2019). West Bengal is the largest producer of sesame and it is usually grown in the summer season after the harvest of the fruitful potato crop. More than 98% of the crop is grown during this period and the production of summer crops is also high compared to kharif and winter crops. Due to high residual fertility, the sesame plant usually achieves excessive vegetative growth, resulting in poor reproduction and lower yields.

There are huge opportunities to improve sesame productivity through agronomic treatments Applying nitrogen to leaves at a specific stage can resolve slow pod growth, nodule senescence and low seed production without root assimilation at a critical stage. Foliar application of nitrogen in the form of urea expressed significantly higher growth traits such as leaf area index, crop growth rate, net assimilation index and leaf specific gravity, indicating greater accumulation of total dry matter production and increased yield. Foliar N application is more suitable than soil application because it allows fast and efficient N transport to the grain. Foliar application of various nutrients such as KNO3, NPK-19:19:19 and K2SO4 can be useful to increase sesame yield. The positive effects of these nutrients can inhibit abscisic acid synthesis and promote cytokinin activity. Other Aspects K+ plays an important role in photosynthesis, carbohydrate breakdown and maintenance of starch synthesis. Organisms were assumed to be responsible for higher grain yields. DAP fertilizer is an excellent source of phosphorus (P) and nitrogen (N) for plant nutrition. Nitrogen is a necessary and basic macronutrient for plants. It is part of protoplasm and also of proteins. Nitrogen is crucial for the production of plant biomass. Phosphorus and potassium also affect the beneficial effect of nitrogen fertilizer. Lack of plant nitrogen slows down photosynthesis and physiological functions. Nitrogen is part of proteins and nucleic acids. It stimulates the growth of underground and aboveground parts of plants, giving them a strong green color. Phosphorus is one of the most common nutrients. It is a component of organic compounds and is therefore used for energy storage and plant metabolism. The transport of phosphorus in the plant is very poor, which can cause a lack of this element. The high concentration of this element in plants stimulates the intensive growth of the root system and really improves the performance. In most cases, plants take up most of the nutrients applied to the soil through the root system, resulting in the desired growth, rooting and high yield. Sometimes, however, physiological stress, such as drought, excessive humidity, insufficient soil pH and too low a temperature, prevents the uptake of nutrients from the soil. Due to insufficient humidity and dryness in spring and summer, the root system of the plant cannot absorb nutrients from the soil, which are needed to achieve a healthy harvest that is quantitatively and qualitatively satisfactory. Foliar fertilizers are completely soluble in water and the necessary nutrients are quickly delivered to plants during the growing season in the form of foliar fertilization. This is especially important when there are large faults and difficulties in the ground due to adverse weather conditions or mechanical conditions. Foliar fertilization provides plants with both macro and micronutrients. Losses of macro- and micronutrients are much lower when applying nutrients to the leaves than when fertilizing the soil. Foliar application of DAP at critical stages of the crop resulted in better photosynthetic activity as reported by contributors. In this experiment, the effect of different chemicals on improving the yield of sesame was studied. With these considerations in mind, an experiment was conducted to determine the effect of foliar nutrients on sesame productivity in a farmer's field. The aim was: To find out the effect of foliar nutrients on summer sesame, if any. To study effective foliar nutrients sesame crop in summer season. The calculated data were analyzed statically and presented as tables and graphs, the corresponding results of which are presented in the following sections.

MATERIALS AND METHODS

Details of the Treatments

The experiment was laid out in a Randomized Block Design (RBD) with three replications. The experimental factors include 10 different foliar spray, thus giving 30 treatments combination in total. The details description of the experimental components adopted for the experiment along with symbols assigned to them are given in Table 1.

Table 1. The treatments applied and their notation

Sl.	Treatments	Notation
1	Waterspray	T-1
2	Potassium Sulfate (K_2SO_4)-0.75%	T-2
3	Potassium Chloride (KCl)- 0.5%	T-3
4	Potassium Chloride (KCl)- 0.75%	T-4
5	Sodium Chloride (NaCl)- 0.5%	T-5
6	Sodium Chloride (NaCl)- 0.75%	T-6
7	NPK19:19:19- 0.5%	T-7
8	NPK19:19:19- 0.75%	T-8
9	NPK10:26:26- 1.5%	T-9
10	Diammonium phosphate (DAP)- 1.5%	T-10

Information on the following cultural activities is given in the following sections. The schedule of cultural activities is given in table 1.

Package of practices

Ploughing, the experimental fields were ploughed first with a tractor disc plow and then with a cultivator. Finally, the body was plowed so that the ground had a good slope. To clean the field, straw was removed from the grass field. The field was completely prepared two days before sowing.

Diffusion by fertilizer in the case of sesame, the field was watered after the last cultivation and according to the treatment, half nitrogen and full doses of phosphorus and potassium were given. Recommended doses of nitrogen, phosphate and potassium in a ratio of 60:30:30 kg/ha were applied to the test plots. For this purpose, 65 kg of urea/ha, 187.5 kg/ha of single superphosphate and 50 kg/ha of urate-potassium chloride and the remaining half of nitrogen (65 kg of urea/ha) were used as a basic dose. After 30 days, in addition to the watering dose, one more watering.

Sowing the seeds,the seeds are sown 3-4 cm deep in rows from east to west.

Seed variety and number Sesame variety Tillotoma (B – 67) was chosen for the experiment. Seeds were supplied at 5 kg/ha.

Distance between seeds the seeds were sown in rows of 20 cm. The distance between the plants was 15 cm. seeds are presented at a depth of 2-3 cm, hand-made.

Thinning was done 15 days after sowing to maintain uniform growth.

Weeding and intercultural activity Two holes were made with a spade to remove weeds and loosen the soil. They were taken after 30 and 50 days of sowing.

Watering Before sowing watering was done before sowing the seeds. The next watering was done in the early growth phase 25 days after sowing and 45 days after sowing in the pre-flowering phase.

Plant protection, Plant protection measures have been used from time to time to keep pests away.

Harvesting and threshing, Sesame catches do not ripen during ripening, ripening begins 90 days after sowing. So, the crop was harvested after 80 days of sowing. The final harvest is done with sickles. The plants of each block are packed separately, the packages are stored with separate labels according to the treatments. The harvested crop was kept on a threshing floor for sun drying for six days, then threshed with bamboo sticks to separate the seeds and cuttings and clean them properly. Collected seeds were kept to dry in sunlight to increase moisture by10-20% for better shelf life.

RESULTS AND DISCUSSION

Table 2. Growth and yield attributes of sesame

Treatments	Capsules/plant	Seeds/capsule	Weight(g)	Yield (kg/ha)
T1-Waterspray	54	74	3.17	750
T2-K_2SO_4(0.75%)	62	79	3.28	1036
T3-KCl(0.5%)	60	83	3.30	1049
T4-KCl(0.75%)	61	85	3.40	1090
T5-NaCl(0.5%)	56	73	3.07	848
T6-NaCl(0.75%)	57	78	3.25	904
T7-NPK19:19:19(0.5%)	82	89	3.31	1389
T8-NPK19:19:19(0.75%)	88	91	3.36	1420
T9-NPK10:26:26(1.5%)	65	86	3.33	1156
T10-DAP(1.5%)	63	80	3.25	1079
CDat5%	6.76	5.00	0.44	45.09

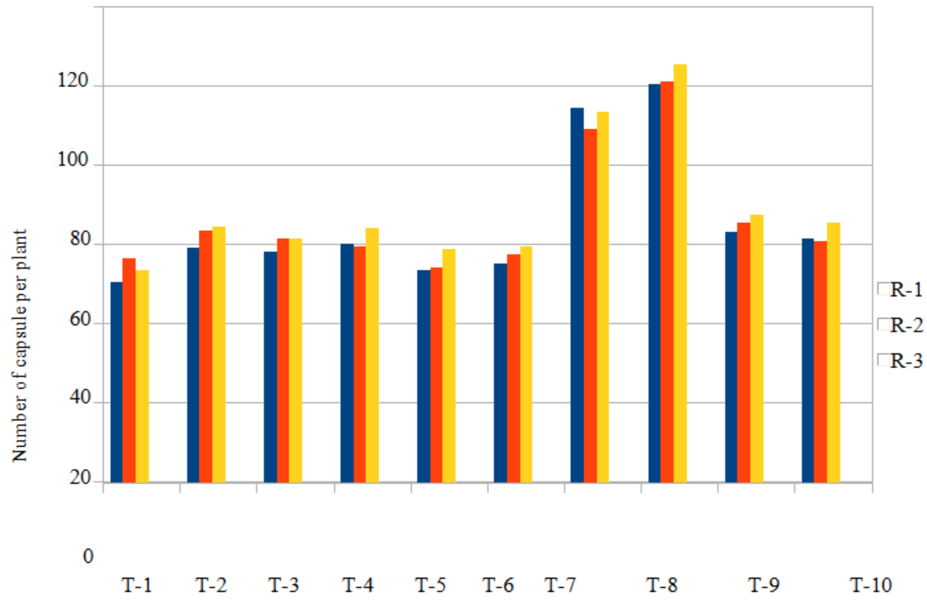

Figure 1. Number of capsules per plant of sesame as affected by different foliar nutrients

Seeds per capsule the number of seeds per capsule are shown, Figure 1. Of the foliar nutrient treatments, N P K 19:19:19 (0.75%) produced the maximum number of seeds per capsule closely followed by N P K 19:19:19 (0.50%) and N P K 10:26:26 (1.5 %). All foliar nutrient treatments are statistically equal. However, all foliar nutrient treatments significantly improved the number of seeds per capsule compared to the control, which could be because the macronutrients would have increased the plant nutrient space, which would have contributed to the transfer of assimilates, which would have increased seed production.

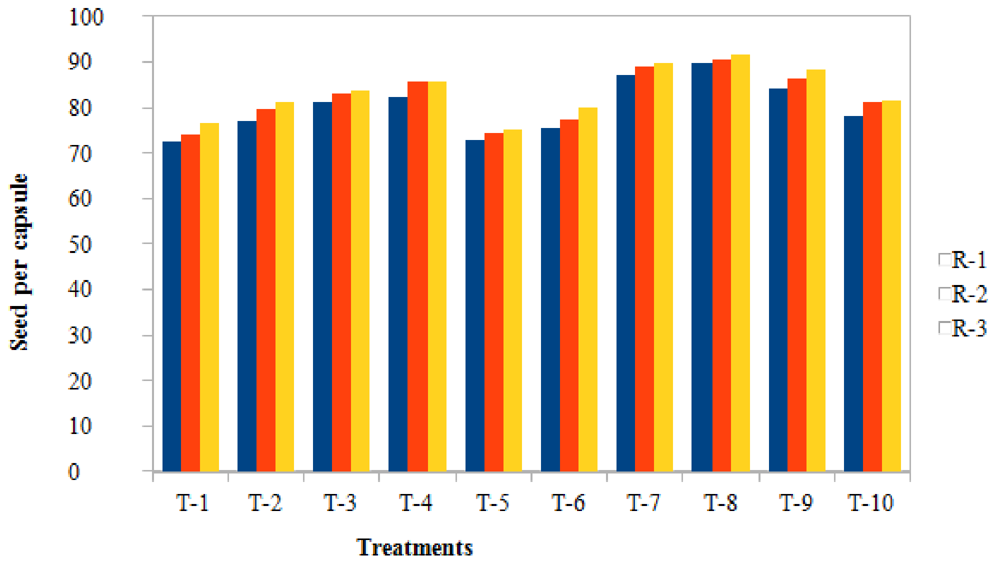

Figure 2. Number of seeds per capsule of sesame as affected by different foliar nutrients

The data presented in Figure 2 Show a significant difference due to the injection of nutrients from different leaves. The weight of the experiment increased significantly with the support of foliar nutrients, and the trend was like the number of seeds per capsule.

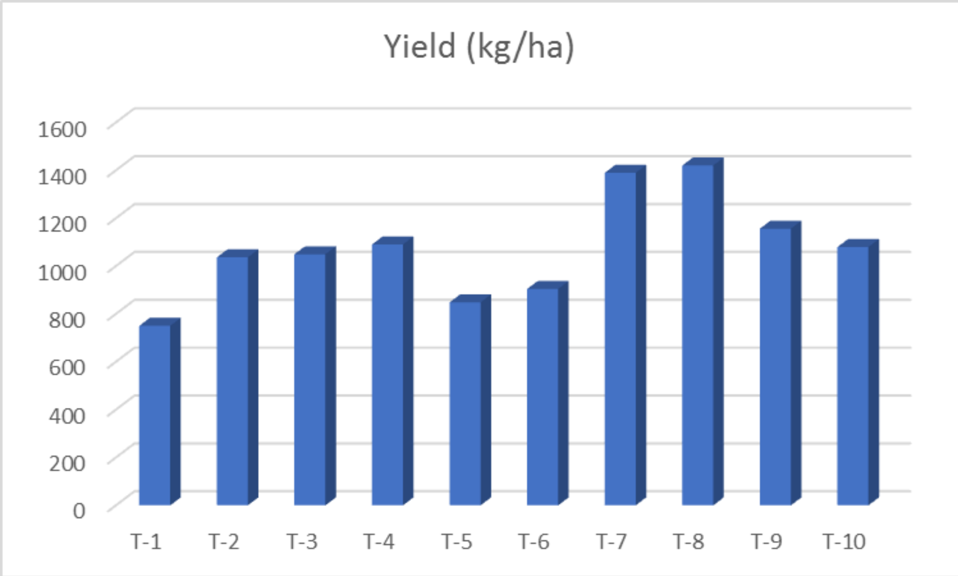

Figure 3. Seed production of sesame as affected by different foliar nutrients

The effect of treatments on seed production is shown in Figure 3. The data clearly show that all foliar nutrients resulted in significantly higher seed yield compared to the control treatment. Of the foliar nutrient treatments, N P K 19:19:19 (0.75%) (1420 kg/ha) achieved the highest seed yield, closely followed by N P K 19:19:19 (0.50%) (1389 kg/ha).

Both these treatments were statistically equal and found to be significantly better than KCl 0.50% (1050 kg/ha) and KCl 0.75% (1090 kg/ha).

Application of nutrients through foliar spray at appropriate growth stages becomes important for their effective utilization and better crop performance. Interest in foliar fertilizers has been driven by the many advantages of foliar application methods, such as rapid and efficient response to plant needs, lower production requirements, and independence from soil conditions. It is also known that additional foliar fertilization at harvest can improve the mineral status of plants and increase yield. During critical growth phases, foliar application of nutrients may be just what plants need to meet yield quality goals. Plants can absorb nutrients not only through roots, but also through leaves, stems, buds and flowers. Foliar nutrition can improve nutrient uptake by 12-20 times compared to traditional fertilizer, resulting in high fertilizer use efficiency to minimize fertilizer acquisition costs. Another important advantage of foliar nutrition is that plants take more nutrients from the soil, because its nutrition through the leaves releases more sugars into the root zone of the plant, which promotes microbial activity to improve biological nitrogen fixation and the availability of essential substances. motifs of plant elements the increase in these parameters can be attributed to the general improvement of plant vigor and the formation of adequate photosynthesis through an increase in leaf area and leaf chlorophyll content. As a result of increased nutrient availability, better nutrient management can have a beneficial effect that increases photosynthesis in determining yield and ultimately yield. Among the foliar nutrients, NPK 19:19:19 and NPK 10:26:26 promoted more yield-enhancing traits and yield, which may be due to altered reproductive growth of the crop, driving more nutrients to reproductive organs and photosynthesis, resulting in in. less flower drop and more capsule development and seed packing into a single capsule. Foliar nutrients may have recorded flower drop by preventing abscission layer formation and also supported this view. A similar trend was observed in terms of seed yield ie. Higher yield was recorded using foliar nutrients NPK 19:19:19 @ 0.5% and NPK 10:26:26 @ 2% than the other two foliar nutrients (KCl @ 0.5% and KCl). @) 0.75%).

The apparent superiority of foliar nutrients is best explained by a temporary lack of nutrients from the soil to the reproductive tissues. The reason may be low root activity in cool/dry soil, hire retirements for flowering poor transport of nutrients to reproductive tissues. All these explanations indicate that transient nutrient deficiencies may occur and may not be effectively corrected by soil fertilization. This is the clearest example of a temporary nutrient deficiency and the rationale for the use of foliar fertilizers. Injection of 25 kg and 2% DAP at early flowering and balsa stages increased pod number and yield compared to control. Summer season 2021 has been decided a total of ten treatment sessions. The experiment was performed in RBD with three replicates. The variety used in the experiment was Tillotoma (B-67). The number of capsules per plant is the main component of sesame yield, the maximum number of capsules per plant was obtained by foliar spray N P K (19:19:19) 0.75% and 0.5% followed by N P K (10:26:26) at 1.5%. In this experiment, all foliar sprays had an increasing effect on the number of capsules per plant compared to the control.

The study clearly shows that, this category N P K (19:19:19) recorded the highest number of sesame seeds followed by N P K (10:26:26). In the foliar treatment, the water spray had the significantly lowest grain yield. According to grain yield T-8 N PK (19:19:19) @0.75% 1st place, T-7 N P K (19:19:19)@0.5% 2nd place, T-9 N PK (10:26:26) @1.5% placed 3rd, T-4 KCl (0.75%) placed 4th. Thus, it can be concluded that foliar application of 1.5% N P K (19:19:19) or NPK (10:26:26) nutrients during flowering of sesame can give a significantly better yield. Therefore, it has been suggested that farmers can use both fertilizers. However, N P K (19:19:19) gives a slightly better result than N P K (10:26:26).

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