EFFECT OF NUTRIENT MANAGEMENT ON YIELD AND YIELD ATTRIBUTES ON PROMISING ~~RELEASED~~ SESAME VARIETIES UNDER RICE-BASED CROPPING SYSTEM OF KRISHNA ZONE

Abstract:
A field experiment was carried out at Agricultural College farm, Bapatla district, Andhra Pradesh during the period from March 2023 to June 2023 to assess the performance of Sesame (*Sesamum indicum* L.*)* varieties under different fertilizer management practices in rice-based cropping system in Krishna Zone of AP. The experiment was laid out in randomised block design with factorial concept with three replications. The results showed that YLM 146 recorded significantly highest seed yield (748 kg ha^{-1}) at harvest. The yield attributing characters like number of capsules $plant^{-1}$ (67) and number of seeds $capsules^{-1}$ (45) were found significantly highest in the variety YLM 146. With regard to different fertilizer management practices,125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage recorded significantly higher seed yield (827 kg ha^{-1}). Yield attributes like number of capsules $plant^{-1}$ (96) and number of seeds $capsules^{-1}$ (51) were significantly highest in 125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage. Overall, the results showed that sowing of YLM 146 variety with 125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage seems to be appropriate for getting higher seed yield in Krishna Zone of Andhra Pradesh.

Keywords: Fertilizer management practices, Growth, Sesame, Varieties, Yield, Yield attributes.

Introduction:
Rice-oil seed system is the dominant cropping system in the Krishna Zone of Andhra Pradesh. But the productivity is very low in the Krishna Zone of Andhra Pradesh over other parts of Andhra Pradesh due to inadequate management practices including low yielding varieties, lack of nutrient management and weed management practices. In this scenario, it is necessary to manipulate the production techniques to raise oil seed production levels in order to satisfy the rising demand. Among the different management factors, Fertilizer management practices and high yielding varieties plays a pivotal role in increasing the production. Fertilizer management practices a key role in obtaining higher yield as it influences the early budding stage and early capsule formation stage seed set. High yielding cultivars also plays an important role in boosting crop production due to their genetic potential that promote higher productivity, disease resistance and adaptability to adverse environmental conditions of varied pressures.

Rice fallow regions provide ample scope for area expansion of oilseeds. In India, rice is cultivated both under irrigated and rainfed conditions in various cropping systems across the length and width of the country occupying about 43 million hectares area (Anonymous,2009). Rice-rice, rice-sugarcane, rice-groundnut, rice-vegetables, rice-pulses, rice-sunflower, rice-

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sesame and rice-fallows are the prevalent rice-based cropping systems in various parts of the country. Major area under rice production during *kharif* season in India remains fallow in the subsequent *rabi* due to various reasons, but lack of production technologies is considered as a major determinant. Being short duration in nature, sesame is an ideal crop for cultivation in rice fallows (Chauhan *et al.*, 2016). To cope up with the increasing demand of oilseeds in the country, sesame should be included as an integral part in rice fallow areas with a dual advantage of crop diversification for sustainable production and increasing the area under sesame. To utilize the rice fallow areas with sesame, location specific and economically viable technology for better performance of sesame are required to be evaluated through a proper understanding of the system ecology and constraints for adoption.

Cereal-oil seed systems occupy an important position in crop rotation, especially in Krishna western delta command area of Krishna Zone of Andhra Pradesh. Rice in *kharif* season and sesame during *summer* season is the newly followed cropping system in Krishna agro climatic zone under irrigated conditions. Sesame is considered as the best rotation crop in the binary rotation system with cereals. Continuous rice-rice crop rotation has led to decline and deterioration of soil physical properties. This problem can be partly overcome by changing from rice-rice crop rotation to growing of cereal-oilseed rotation system. Promotion of rice fallow sesame would also improve sustainability of the rice production system besides enhancing production and augmenting income. It should be considered appropriate to identify the constraints in *rabi* cropping that can be addressed through appropriate technological intervention. Considering the scope for area expansion in rice fallow areas, this study was conducted to identify suitable sesame variety and nutrient levels for rice fallow/follow sesame cropping system.

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Material and Methods

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A field experiment was conducted at Agricultural college farm, Bapatla, Krishna Zone of Andhra Pradesh during *summer*, 2022 to 2023 in rice fallow situation. The experimental site is situated at an altitude of 5.49 meters above mean sea level, 15^0 54' North latitude, 80^0 30' East longitude and about 7 km away from the Bay of Bengal. It is located in the coastal area of the Krishna Agro Climatic Zone of Andhra Pradesh, India. The climate of Andhra Pradesh is generally hot and humid. The experimental site was homogeneously fertile with flat and smooth topography and uniform texture. The experimental soil was found to be sandy loam, slightly acidic in reaction, low in organic carbon (0.3%), low in available N (238 Kg ha^{-1}), low in available P_2O_5 (23 Kg ha^{-1}) and high in available K_2O (380 Kg ha^{-1}).

The experiment was laid out in randomised block design with factorial concept with three replications. Factor A include three varieties *viz* YLM 66, YLM 142 and YLM 146 and Factor B include five Fertilizer management practices *viz*. T_1= Control,

T_2= 50% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage;

T_3= 75% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage;

T_4= 100% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage;

UNDER PEER REVIEW

T_5= 125% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage.

Dibbling method of sowing was followed with a spacing of 30 cm x 15 cm with a gross plot size of 5.4 m x 4.5 m. As fertilizers were applied 2 foliar sprays of nutrients 19:19:19 (N:P:K) @ 10gL^{-1} were given at 40 DAS and further one more spray at 50 DAS. No.of 5 tagged plants from net plot area was measured. The total number of capsules from the five tagged plants were counted at harvest and then average number of capsules plant^{-1} and no. of seeds capsule^{-1} was calculated. Seed yield from square meter area was recorded and expressed in kg ha^{-1}.

Results and Discussion

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Seed yield

Data recorded on seed yield of sesame as influenced by varieties and fertilizer levels are presented in Table 1. Seed yield obtained in YLM -146 was higher by significantly influenced by varieties, the highest seed yield (748 kg ha^{-1}) was recorded with variety YLM 146 (V_3) which was superior to rest of the varieties whereas the lowest seed yield (520 kg ha^{-1}) was observed in variety YLM 66 (V_1). Seed yield in YLM-146 was higher by 21.4 and 43.84 per cent over YLM-142 and YLM-66, respectively. The increase in seed yield of YLM-142 over YLM-66 was 18.4 per cent. These findings are in line with the findings of Raja *et al.* (2007a), Nahar *et al.* (2008) and Jat *et al.* 2017a).

Increasing the fertilizer levels, there was a significant increased seed yield. Application of 125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_5) recorded highest seed yield of 827 kg ha^{-1}. This was significantly superior to other fertilizer tried. Applying 100% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage gave (T_4) 720 kg ha^{-1} was on par with 100% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_3). The per cent increase in seed yield with a fertilizer level was 14.8, 27.8, 63.1 and 42.7 over T4, T3, T2 and T1 treatments respectively. The gain in seed yield due to 25% enhancement in fertilizer dose (125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage) over the recommended dose of NPK applied to soil (100% RDF + + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage) was worked out to be 14.8.0%, clearly showing that the currently recommended dose of NPK (40:20:20 kg NPK ha^{-1}) was suboptimal. The lowest seed yield (429 kg ha^{-1}) was recorded with control (T_1) and found statistically inferior to rest of the treatments.

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The improvement in seed yield with enhanced fertilizer level might be attributed to better availability and uptake of nutrients which in turn might have led to efficient metabolism. Higher levels of biomass accumulation and efficient translocation of ~~photosynthates~~photosynthesis from source to sink might be responsible for the increased seed yields. The increase in sink capacity resulted in improved yield attributes which was evidence through Table 2 and consequently raised the grain yield of sesame. This is further supported by the fact that the soil of experimental field was low in nitrogen (238 kg ha^{-1}). Thus, an increase in nitrogen supply might have increased all the growth parameters, yield attributing characters which ultimately contributed to increase in seed yield. The above results are in

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conformity with the findings of several researchers such as Shehu *et al.* (2010) and Kashani *et al.* (2015), Hasan *et al.* (2013) and Maryam Jasemi *et al* (2013).

Table 1. Seed yield of sesame varieties as influenced by different nutrient management practices

Treatments		Seed yield (kg ha^{-1})
Varieties (A)		
	V_1: YLM 66	520
	V_2: YLM 142	616
	V_3: YLM 146	748
	SEm(±)	19.59
	CD (P=0.05)	57
Fertilizer levels (B)		
	T_1: Control	429
	T_2	507
	T_3	647
	T_4	729
	T_5	827
	S.Em(±)	25.30
	CD (P=0.05)	73
Interaction (A x B)		
	S.Em(±)	43.81
	CD (P=0.05)	127

Interaction effect

Seed yield of sesame was found to be the highest with V_3 (YLM -146) at T_5 (125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage, which was superior to rest of the treatment combinations.) which was however found statistically superior to rest of combinations. The variety YLM -146 at 100% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage was next height seed yield but it was on par with same variety with 75 % RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage, this is indicating that the supplemental 1% foliar feeding over the application of 75 % RDF to soil was inadequate in realization of the highest seed yield as compared to 100% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage, in rice fallows of sesame (Table 1a). The lowest seed yield was realized with variety V_1 (YLM-66) at T_1 (control). Similar results were confirmed by Kashani *et al.* (2015) and Mekonnen *et al.* (2016).

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Table 1a: Interaction between varieties and nutrient management practices on seed yield (kg ha^{-1}) of sesame.

Fertilizer Levels	Variety		
	V_1	**V_2**	**V_3**
T_1	335	402	552
T_2	397	531	593

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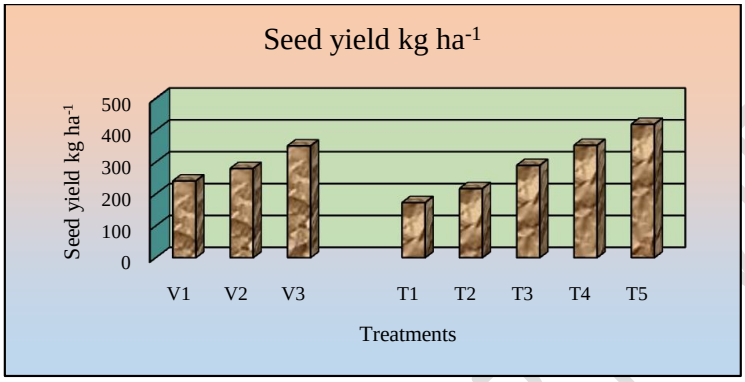
T_3	561	690	691
T_4	681	696	811
T_5	627	760	1093
S.Em±		43.8	
CD (P=0.05)		171.0	

Fig. 1. Interaction between varieties and nutrient management practices on seed yield (kg ha^{-1}) of sesame.



Yield attributes

No. of capsules plant^{-1}

Data which was recorded on no. of capsules plant^{-1}are presented in Table 2 Number of capsules plant^{-1} was significantly affected due to different varieties and nutrient levels but not their interaction. No. of capsules plant^{-1} (67) obtained with YLM-146 (V_3) were found significantly higher compared to YLM-66 (V_1) but it was on par with YLM-142 variety (V_2). However minimum no. of capsules plant^{-1}(60) was observed in variety YLM 66 (V_1). This may be due to hereditary behavior of sesame varieties and their different growth habits. Similar type result also reported by Throve *et al.* (2011), Kashani *et al.* (2015) and Jat *et al.* (2017).

In case of fertilizer levels, application of 125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_5) significantly produced maximum no. of capsules plant^{-1}(96) which was superior to rest of the fertilizer levels. The no. of capsules plant^{-1} was found to be significantly higher with 100 % RDF + 1 % foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_4) over to 50 % RDF + 1 % foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_3) and control (T_1) treatment but it was on par with 75 % RDF + 1 % foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_4). Whereas the minimum no. of capsule plant^{-1}(35) was recorded under control (T_1). Its role in various biochemical processes in the plant has been described by many scientists. Nitrogen by virtue of its link in the process of photosynthetic process and cell division, cell partitioning increased the dry matter accumulation at higher N levels. This higher dry matter and its partitioning might have

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resulted in more no. of capsules plant^{-1} in sesame and also this might be due to more vigorous and luxuriant vegetative growth due to nitrogen application, which in turn favoured a better partitioning of assimilates from source to sink. The present results were in accordance with the findings of Subramanian and Ganesaraja (1992), Kushwaha (2013).

No. of seeds per capsule

Data pertaining to the effect of various varieties and fertilizer levels on the number of seeds capsule^{-1}are presented in Table 2 reveals that no. of seeds capsule^{-1} significantly differ with varieties and fertilizer levels. Number of seeds per capsule with YLM-146 (V_3) produced maximum no. of seeds per capsule (45) and it was significantly higher compared to YLM-66 but found statistically at par with YLM-142 (V_2) and the minimum no. of seeds per capsule (40) was recorded in variety YLM 66 (V_1). These findings are in line with the findings of Throve *et al.* (2011), Jat *et al.* (2017) and Meena (2013).

Application of nutrients significantly increased no. of seeds per capsule. Application of 125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage(T_5) recorded significantly higher number of seeds per capsule (51) over to which was on par with 100% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage(T_4). Whereas the lowest number of seeds per capsule was recorded with control (T_1). Which might be due to improved source sink relationship, with efficient translocation of ~~photosynthates~~photosynthesis to the grains. Reverse is the case of lower fertilizer levels and hence low number of filled grains per ear head was recorded with fertilizer levels. These results are in conformity with the findings of Meena (2013), Hasan *et al*. (2013) and Jat *et al.* (2017a).

Test weight (g)

Significantly highest test weight (2.9 g) was observed with the application of 125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_5) over to 50% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_2) and control (T_1) but it was on par with 100% RDF +1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_4) and 75% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage (T_3). The increase in thousand grain weight might ~~due to~~ due to higher nitrogen levels and efficient dry matter partitioning besides better translocation to the sink, leading to the formation of large sized grains as a result of adequate availability of nutrients at the time of grain filling. This ultimately accountable in higher test weight. This is in the accordance with the results reported by Gutu *et al.* (2016); Chakraborty (2013); Swain *et al.* (2020); Zebene and Negash(2022).

Table 2: Yield attributes ~~and oil yield~~ (kg ha^{-1}) of sesame as influenced by different nutrient levels during *summer* season

Treatments	No. of capsule pant^{-1}	No. of Seeds capsule^{-1}	1000 seed weight (g)
T_1: Control	35	32	2.3
T_2	42	38	2.4
T_3	72	43	2.8

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T_4	78	50	2.8
T_5	96	51	2.9
S.Em (±)	2.6	1.1	0.1
CD (P=0.05)	7 .0	4.0	0.3

Fig. 2. No. of capsule pant^{-1} of sesame varieties as influenced by different nutrient management practices

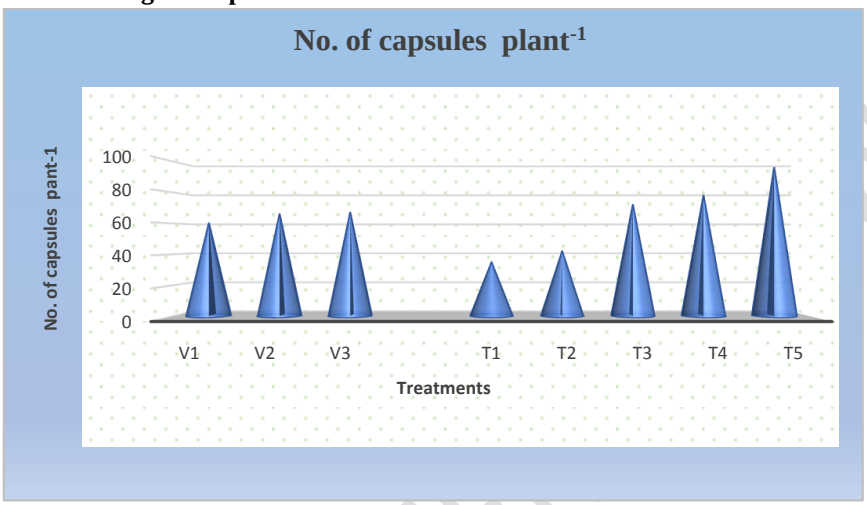

Fig. 3. No. of Seeds capsule^{-1} of sesame varieties as influenced by different nutrient management practices

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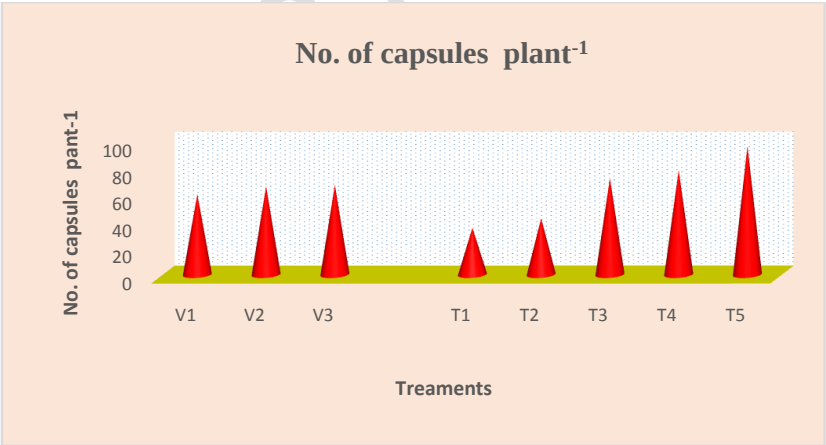

Conclusion

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Seed yield and yield attributes were highest with variety YLM 146 and fertilizer management practice of ~~A~~application of 125% RDF + 1% foliar spray of 19:19:19 at early budding stage and early capsule formation stage which indicates that YLM 146 coupled with 125 % RDF

application seems to be appropriate for getting higher seed yield and yield attributes in Krishna Zone of Andhra Pradesh.

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