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Effect of fertility levels on growth and yield of taramira (*Eruca sativa* L.)

Abhishek Sharma, Kartikeya Choudhary and Ranjeet Singh Bochalya

Abstract
The present investigation titled "Effect of Fertility Levels on Growth and Yield of Taramira (*Eruca sativa* L.)" was conducted during *rabi* season of 2022-23 at Chamelti Agriculture Farm, MS Swaminathan School of Agriculture, Shoolini University of Biotechnology and Management Sciences, Solan, Himachal Pradesh. The soil of the experimental site was sandy loam in texture, slightly alkaline in reaction with EC in safer range, medium in organic carbon, available nitrogen, potassium and high in available phosphorus. The field experiment way laid out in randomized block design comprising nine treatments *viz*. (T_1) control, (T_2) 50% RDF, (T_3) 100% RDF, (T_4): 50% RDF + 25 kg S ha^{-1}, (T_5) 100% RDF + 25 kg S ha^{-1}, (T_6) 50% RDF +35 kg S ha^{-1}, (T_7) 100% RDF +35 kg S ha^{-1}, (T_8) 50% RDF +45 kg S ha^{-1} and (T_9) 100% RDF +45 kg S ha^{-1}. Recommended dose of nitrogen, phosphorus and potassium (80:40:40 kg ha^{-1}) was applied through urea (46% N), SSP (16% P_2O_5), MOP (60% K_2O) at the time of sowing. However, sulphur was applied through Gypsum (18%S). TMLC-2 variety of taramira was used for sowing. Other crop management practices were followed as per the recommendation of the area. Results revealed that significantly higher growth and yield attributes was observed in treatment (T_9) 100% RDF + 45 kg S ha^{-1} statistically at par with (T_7) 100% RDF + 35 kg S ha^{-1} except for siliquae length. Whereas, significantly higher yield was observed in treatment (T_9) 100% RDF + 45 kg S ha^{-1} statistically at par with (T_8) 50% RDF + 45 kg S ha^{-1}, (T_7) 100% RDF + 35 kg S ha^{-1}, (T_6) 50% RDF + 35 kg S ha^{-1}, (T_5) 100% RDF + 25 kg S ha^{-1}.

Keywords: Taramira, sulphur, siliquae, gypsum and accumulation

Introduction
Taramira (*Eruca sativa*) also known as "Rocket salad" is an important non-edible oilseed crop among rapeseed and mustard group and has tremendous potential even under the situation of resource constraint. It is generally cultivated on marginal and sub marginal lands of poor fertility without application of organic manures and fertilizers which is one of the most spectacular reasons of its poor productivity. In addition of nitrogen and phosphorus, global reports of sulphur deficiency and consequent crop responses are also quite ostensible. Optimum dose of nutrients and their source play an important role in enhancing the productivity of crops. Primary nutrients i.e. nitrogen, phosphorus and potassium along with sulphur play a pivotal role in crop yield. About 98% of the cultivated Indian soils required phosphorus fertilization for getting better yield (Bhari *et al*., 2000 and Singh *et al*., 2010) [1, 11]. Various studied indicated that the increasing levels of nutrient resulted concomitantly increasing yield of taramira. Therefore, this study was initiated to evaluate the various levels of nutrient on growth and yield of taramira.

Materials and Methods
The present research work titled "Effect of Fertility Levels on Growth and Yield of Taramira (*Eruca sativa* L.)" was conducted during November to March month of 2022-23 at Chamelti Agriculture Farm (latitude 30º 85'67.30 N, longitude 77º 13'20.38 E and elevation of 1270 meters above mean sea level), MS Swaminathan School of Agriculture, Shoolini University of Biotechnology and Management Sciences, Solan. The soil of the experimental site was homogeneous in fertility status with uniform textural make up. The soil of the experimental site was sandy loam in texture, slightly alkaline in reaction with EC in safer range, medium in organic carbon, available nitrogen, potassium and high in available phosphorus. The field experiment way laid out in randomized block design comprising nine treatments *viz*. (T_1) control, (T_2) 50% RDF, (T_3) 100% RDF, (T_4): 50% RDF + 25 kg S ha^{-1}, (T_5) 100% RDF + 25 kg S ha^{-1}, (T_6) 50% RDF + 35 kg S ha^{-1}, (T_7) 100% RDF + 35 kg S ha^{-1}, (T_8) 50% RDF + 45

kg S ha^{-1} and (T_9) 100% RDF + 45 kg S ha^{-1}. Recommended dose of nitrogen, phosphorus and potassium (80:40:40 kg ha^{-1}) was applied through urea (46% N), SSP (16% P_2O_5), MOP (60% K_2O) at the time of sowing. However, sulphur was applied through gypsum (18% S). TMLC-2 variety of taramira was used for sowing. Other crop management practices were followed as per the recommendation of the area.

Results and Discussion

Growth parameters

Growth parameters of taramira differed significantly due to different fertility levels at harvesting (Table 1). The data revealed that significantly higher plant height (98.80 cm), number of branches (19.70 $plant^{-1}$) and dry matter accumulation (35.80 g $plant^{-1}$) with application of (T_9) 100% RDF + 45 kg S ha^{-1} as compared to other treatments which was statistically at par with (T_7) 100% RDF + 35 kg S ha^{-1}.

As we know that nitrogen plays an essential role in the creation of proteins, chlorophyll, and other organic compounds with physiological importance and also helps in cell elongation and cell division which helped in the increment in height of plant. Whereas, phosphorus and potassium helped in shoot development, transformation of sugars and starches, nutrient movement within plant and translocation of photosynthesis, protein synthesis from source to sink which might be the reason of increased vegetative growth of plant. On the other hand, sulphur played important role in providing nutritional environment for plant growth at active vegetative stage which resulted in improvement in roots growth, cell multiplication, better chlorophyll synthesis, elongation and cell expansion in the plant body which ultimately increased the plant height and the number of branches $plant^{-1}$. The improvement in morphological characters (plant height and branches $plant^{-1}$) appears to have boosted photosynthetic efficiency, leading to a higher generation of dry matter and their effective distribution in different plant parts. Similar results were observed by Kumar *et al*. (2018) [5]; Kumar and Yadav (2007) [6]; Gurjar *et al*. (2017) [3] and Dabi *et al.* (2015) [2].

Yield attributes

Yield attributes of taramira showed significant difference due to different fertility levels except for test weight (Table 2). Significantly higher number of siliquae $plant^{-1}$ (74.86), number of seeds $siliquae^{-1}$ (23.80), siliquae length (1.98 cm) and seed yield (5.67 g $plant^{-1}$) were recorded under (T_9) 100% RDF + 45 kg S ha^{-1} which was statistically at par with (T_7) 100% RDF + 35 kg S ha^{-1} except siliquae length. However, maximum value of test weight (3.0 g) was also recorded with application of (T_9) 100% RDF + 45 kg S ha^{-1} but the difference was found to be non-significant. The favourable effect of higher level of nitrogen, phosphorus, potassium and sulphur on various yield attributes was may be due to increased production of vegetative parts, with similar production of photosynthates and identically proportioning of the associates for reproductive growth. In addition to the direct role, higher nitrogen application was responsible for more efficient utilization of phosphorus and potassium which further improved both vegetative and reproductive growth. Whereas, application of sulphur @ 45 kg ha^{-1}, helped in the better partitioning of the photosynthates and their translocation to reproductive parts that improve the seed to stover ratio which is reflected in terms of increased yield attributes of the crop. Similar results were noticed by Jat *et al.* (2005) [4]; Rana *et al*. (2005) [9]; Mandal and Chattopadhyay (2009) [8].

Yield

Yield of taramira also influenced by fertility levels (Table 3). Significantly higher seed (465.89 kg ha^{-1}), stover (2377.50 kg ha^{-1}) and biological yield (2841.92 kg ha^{-1}) was recorded with application of (T_9) 100% RDF + 45 kg S ha^{-1} which was statistically at par with (T_8) 50% RDF + 45 kg S ha^{-1}, (T_7) 100% RDF + 35 kg S ha^{-1}, (T_6) 50% RDF + 35 kg S ha^{-1} and (T_5) 100% RDF + 25 kg S ha^{-1} over rest of the treatments. This might be due to that yield of crop is the result of different yield attributes like number of siliquae $plant^{-1}$, number of seeds $siliquae^{-1}$, and test weight which directly influence the seed and stover yield. Higher the yield attributes, higher the yield. Increase in yield due to yield attributes also noted by Rana *et al*. (2019) [10]. This might also be due to adequate sulphur availability during the whole cropping period for better vegetative growth and development of taramira plants. These findings are in conformity with the Kumar *et al.* (2009) [7] and Rana *et al*. (2019) [10].

Table 1: Effect of fertility levels on growth parameters of Taramira at harvest

Treatments	Plant height (cm)	No. of branches $plant^{-1}$	Dry matter accumulation (g $plant^{-1}$)
T_1: Control	60.02	8.40	16.90
T_2: 50% RDF	73.21	10.10	22.50
T_3: 100% RDF (80:40:40 kg NPK ha^{-1})	80.50	15.88	28.95
T_4: 50% RDF + 25 kg S ha^{-1}	75.10	10.38	20.80
T_5: 100% RDF + 25 kg S ha^{-1}	84.20	16.55	30.60
T_6: 50% RDF + 35 kg S ha^{-1}	83.55	13.70	22.32
T_7: 100% RDF + 35 kg S ha^{-1}	96.55	17.82	31.72
T_8: 50% RDF + 45 kg S ha^{-1}	87.52	14.25	29.35
T_9: 100% RDF + 45 kg S ha^{-1}	98.80	19.70	35.80
S.Em ±	2.28	0.53	1.35
LSD (p=0.05)	6.86	1.88	4.09

Table 2: Effect of fertility levels on yield attributes of Taramira

Treatments	Yield attributes				
	No. of siliquae plant^{-1}	No. of seeds siliquae^{-1}	Siliquae length (cm)	Test weight (g)	Seed yield plant^{-1} (g)
T_1: Control	65.97	18.97	1.50	2.5	2.10
T_2: 50% RDF	67.63	19.10	1.59	2.6	2.24
T_3: 100% RDF (80:40:40 kg NPK ha^{-1})	72.89	22.97	1.64	2.6	2.47
T_4: 50% RDF + 25 kg S ha^{-1}	68.63	20.83	1.72	2.6	3.30
T_5: 100% RDF + 25 kg S ha^{-1}	73.10	23.10	1.76	2.7	4.00
T_6: 50% RDF + 35 kg S ha^{-1}	69.97	21.26	1.78	2.7	3.93
T_7: 100% RDF + 35 kg S ha^{-1}	73.70	23.50	1.82	2.8	5.24
T_8: 50% RDF + 45 kg S ha^{-1}	72.08	21.90	1.88	2.8	4.41
T_9: 100% RDF + 45 kg S ha^{-1}	74.86	23.80	1.98	3.0	5.67
S.Em ±	1.63	0.46	0.04	0.2	0.15
LSD (*p*=0.05)	5.58	1.40	0.15	NS	0.47

Table 3: Effect of fertility levels on yield of Taramira

Treatments	Yield (kg h^{-1})		
	Seed yield	Stover yield	Biological yield
T_1: Control	280.00	1680.10	1960.01
T_2: 50% RDF	372.78	2167.10	2539.88
T_3: 100% RDF (80:40:40 kg NPK ha^{-1})	406.67	2260.41	2667.08
T_4: 50% RDF + 25 kg S ha^{-1}	381.11	2172.60	2553.71
T_5: 100% RDF + 25 kg S ha^{-1}	419.67	2335.46	2755.13
T_6: 50% RDF + 35 kg S ha^{-1}	411.44	2207.68	2619.12
T_7: 100% RDF + 35 kg S ha^{-1}	463.00	2366.43	2829.43
T_8: 50% RDF + 45 kg S ha^{-1}	425.33	2293.75	2719.08
T_9: 100% RDF + 45 kg S ha^{-1}	465.89	2377.50	2841.92
S.Em ±	18.29	59.75	72.84
LSD (*p*=0.05)	54.88	209.35	232.87

Conclusion

The experimental result revealed that the significantly higher growth characters, yield attributes and yield were improved with the application of (T_9) 100% RDF + 45 kg S ha^{-1} which was statistically at par with treatment (T_7) 100% RDF + 35 kg S ha^{-1} which was statistically at par with (T_7) 100% RDF + 35 kg S ha^{-1} except for test weight.

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