International Journal of Agriculture and Plant Science
www.agriculturejournal.in
Online ISSN: 2664-7664
Received: 19-04-2026, Accepted: 20-05-2026, Published: 04-06-2026
Volume 8, Issue 2, 2026, Page No. 228-231

Agronomic evaluation of taramira (*Eruca Sativa* Mill.) genotypes under various fertility levels

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DOI: https://doi.org/10.66856/ijaps.2026.8.2.8112

Abstract
An experiment was conducted during the *rabi* season of 2020-21 by the AICRP on Oilseeds (Taramira Unit), SKNAU, Jobner to evaluate the performance of promising taramaira genotypes under various fertility levels. The experiment was laid out in split plot design assigning taramira genotypes in main plot (RTM 1624, T 27, RTM 314, RTM 1351 and filler) and fertility levels in sub plot (100% RDF, 125% RDF and 150% RDF). Different taramira entries varied widely in seed yield and economic returns. Producing the seed yield of 1272 kg/ha, RTM-1624 was found the most superior genotype. It also registered the maximum values of yield attributes, net returns (Rs. 51819 /ha) and B: C ratio (3.07). RTM-1351 was the next better genotype of taramira that provided seed yield of 1129 kg/ha. Different fertility levels also significantly influenced the yield attributes, yield and net returns of taramira. Progressive increase in level of fertility significantly increased the yield of taramira over preceding level upto 125 % level. Further increase in level to 150% did not bring significant variation in these respects. Application of 150 % RDF resulted in significantly the highest seed yield of 1161 kg/ha. It also fetched the maximum net returns (Rs. 62676 /ha) and B: C ratio (2.63). However, it was found at par with 125% RDF application wherein, the corresponding figures were 1139 kg/ha, Rs. 45401 /ha and 2.64.

Keywords: Genotype, fertility, net returns, taramira, yield

Introduction
Taramira is an important *rabi* season oilseed crop which belongs to family Brassicaceae. Taramira is an herbaceous annual, 2 to 4 feet tall and is a common cold weather oilseed crop of the arid areas of north-west India, where, it is generally grown and mixed with gram and barley. The oil content of taramira varies between 31.60 to 41.31% (Ola *et al.,* 2022) [8]. Taramira oil is mostly used to increase the pungency of mustard oil Kuri *et al.* (2022) [7] It has efficient deep penetrating root system which permits extraction of soil moisture from deeper soil layers (Singh and Sharma, 1976) [9]. It can be grown on poor moisture soils like sandy soils and in dryland regions. Its oil is mostly used in soap making, plastics, lubricants, grease and paints. In Europe it is known as rocket salad, rocket, roquuette or arrugula, where it is generally grown for young leaves that are eaten as green salad. Taramira cake may be used as manure to improve soil physical condition and fertility, as well as nutritional feed for animals (Elizabeth *et al.,* 2021) [4]. Taramira is mainly grown in the states like Rajasthan, Haryana, Punjab, Gujarat and Madhya Pradesh. Major taramira growing districts in Rajasthan are, Jaipur, Tonk, Sawai Madhopur, Sri Ganganagar, Bhilwara and Dausa. Taramira's low productivity is caused by a lack of improved methods, the use of locally accessible varieties, and a lack of varieties with diverse traits. Environmental factors and genetics affect how taramira reacts to fertilizer application. Although improved and promising genotypes have a greater potential for yield, their effectiveness is mostly dependent on the soil's nutrient availability. Therefore, increasing the productivity and profitability of taramira production requires both the identification of appropriate genotypes and the management of fertility levels.

In recent years, efforts have been made to create taramira genotypes that are nutrition responsive and have excellent yields. There is, however, little data on how these potential genotypes function under different fertility levels. Therefore, the present study was conducted with the objective to assess promising taramira genotypes under various fertility levels and identify suitable genotype - fertility combination for higher yield and returns.

Material and Methods
A field experiment was carried out during rabi season of 2020–21 at Agronomy Farm, S.K.N. College of Agriculture, Jobner (26 05' North latitude, 75 28' East longitude, and 427 meters above mean sea level), located in the state of Rajasthan's agroclimatic zone III A (Semi-arid Eastern Plain Zone). The soil used in the experiment was loamy sand with low levels of organic carbon (0.26%), available N (134.6 kg/ha), available P (16.4 kg/ha), and medium levels of available K (147.6 kg/ha). During winter season (October to March), the weather conditions at Jobner (Rajasthan) showed a gradual decline in temperature along with relatively low and erratic rainfall. Maximum temperature ranged from 34.6°C in October to 22.6°C in January, while minimum temperature varied from 15.8°C to 5.4°C, indicating peak winter in December–January (Fig 1). Overall, the season was characterized by cool, dry winter conditions with limited rainfall and adequate sunshine, typical of the semi-arid climate of western Rajasthan, which is suitable for rabi crop growth. The experiment was laid out in split plot design assigning taramira genotypes in main plot (RTM 1624, T 27, RTM 314, RTM 1351 and filler) and fertility levels in sub plot (100% RDF, 125% RDF and

150% RDF). It was replicated thrice. The recommended fertilizer dose was 30 kg nitrogen (N) and 20 kg phosphorus (P_2O_5) per hectare. The crop was sown on 24th October, 2020. The crop was sown with a seed rate of 5 kg/ha, with rows spaced 30 cm apart and plants spaced 10 cm apart. All agronomic practices were followed according to package of practices of zone.

Five sample plants were chosen at random and tagged from each net plot during harvest in order to document measurements of plant height, number of branches, number of siliquae, and number of seeds per siliqua. Each net plot's crop was collected and thoroughly sun-dried after it reached maturity. Before threshing, the total weight of the sun-dried crop from each plot was measured and expressed as biological yield (kg/ha). The harvested produce was then cleaned, dried, and threshed, and the seed yield was noted separately. Based on current market pricing, the economics of different treatments were calculated considering the cost of cultivation and the returns from produce. All the plant protection measures were adopted to ensure a healthy crop. In order to determine the trend of treatments used in accordance with Gomez and Gomez (1984) [5], analysis of the data was also conducted in addition to statistical analysis of the experimental data using the conventional methods of analysis of variance. The critical difference at the 5% probability level was used for the mean comparison.

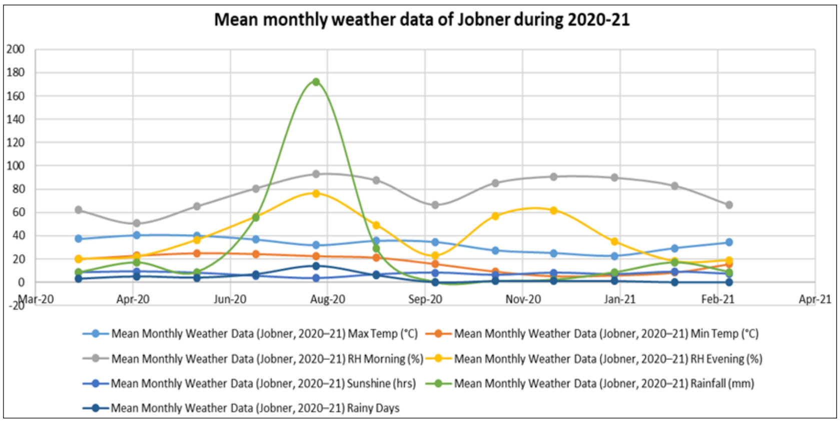

Fig 1: Mean monthly weather data of Jobner during the year 2020-21

Results and Discussion

Growth and Yield Attributes

The data revealed (Table 1) that different genotypes of taramira varied in terms of growth characters, yield attributes and yield. Amongst genotypes, RTM 1351 recorded maximum plant height (108.53 cm) at harvest which was statistically at par with RTM 1624 (104.08 cm) and significantly superior over T 27, RTM 314 and filler. Their distinct genotypic traits may be the cause of the variation in plant height. Banga *et al.* (2013) [1] have also reported similar genotype-related variations in plant height. Genotype RTM 1624 recorded the highest number of primary (6.70) and secondary branches (11.01), siliquae/plant (108.60), seeds/siliquae (18.78) and test weight (3.83). The next best genotype in this regard was RTM 1351. The genotypes' innate genetic and varietal traits might be responsible for the variation in yield attributes between them. Banga *et al.* (2013) [1] has also documented similar variations in yield characters across different genotypes.

Different fertility levels exhibited a significant effect on growth and yield attributes of taramira (Table 1). Among fertility levels, application 150 % RDF recorded maximum plant height (103.49 cm), primary (6.43), & secondary branches (10.17), siliquae/plant (101.23), seeds/siliquae (17.65) and test weight (3.73 g). However, it was statistically at par with 125 % RDF and both these levels were significantly higher over 100 % RDF. The favourable effect of higher fertility levels on yield attributes might be due to better availability and uptake of nutrients which increased production of vegetative parts, photosynthates and their translocation to reproductive parts. Similar results were also reported by Devatwal *et al.* (2023) [3].

Table 1: Effect of genotypes and fertility levels on yield attributes of taramira

Treatments	Plant height (cm)	Branches / plant		Siliquae/ plant	Seeds/ siliqua	Test weight (g)
		Primary	Secondary			
A. Taramira varieties						
V_1 –RTM 1624	104.08	6.70	11.01	108.60	18.78	3.83
V_2- T 27	97.78	6.35	9.48	100.07	17.54	3.68
V_3- RTM 314	91.48	5.02	8.79	87.13	15.77	3.48
V_4- RTM 1351	108.53	6.39	10.30	102.11	18.20	3.73
V_5- Filler	98.92	5.44	9.46	92.11	16.07	3.58
CD at 5%	9.11	0.69	0.84	8.06	1.26	0.21
CV (%)	7.89	10.12	7.40	7.13	7.55	5.01
B. Fertility levels						
F_1- 100 % RDF	95.24	5.26	9.21	92.31	16.62	3.55
F_2- 125 % RDF	101.75	6.25	10.04	100.48	17.54	3.70
F_3- 150 % RDF	103.49	6.43	10.17	101.23	17.65	3.73
CD at 5%	5.56	0.47	0.53	6.03	0.81	0.13
CV (%)	7.38	10.49	7.15	8.17	6.15	5.03

Yield and Economics

The different taramira genotypes exerted significant variation in seed yield andeconomic returns (Table 2). Among the genotypes, RTM 1624 recorded the highest seed yield (1272 kg/ ha), gross returns (Rs. 68,706/ha), net returns (Rs. 51,819/ ha) and benefit:cost ratio (3.07). RTM 1351 was found to be the next promising entry, producing a seed yield of 1129 kg/ ha along with gross returns of Rs 60,948 /ha, net returns of Rs. 44,061/ha and a B:C ratio of 2.61. In contrast, RTM 314 recorded the lowest seed yield (1020 kg/ha), gross returns (Rs. 55,068/ha), net returns (Rs. 38,181/ha) and B:C ratio (2.26). Differences in mustard genotypes' genetic composition, which affects their growth, development, and yield potential, may be responsible for yield variation. Solanki *et al.* (2015) [10] published similar findings, noting that genetic variability among genotypes is a major factor in driving yield differences in mustard.

Fertility levels had a marked influence on the yield and economic returns of taramira genotypes (Table 2). The highest seed yield (1161 kg/ha) was recorded with the application of 150% RDF, which was closely followed by 125% RDF (1139 kg/ha). The lowest seed yield (1047 kg/ha) was observed under 100% RDF. Compared to 100% RDF, the seed yield increased by about 8.8% under 125% RDF and 10.9% under 150% RDF, indicating a clear positive response of taramira to enhanced nutrient supply. Economic returns showed a similar pattern, with 150% RDF producing the best gross returns (Rs 62,676/ha) and net returns (Rs 45,751/ha), while 125% RDF produced the highest benefit:cost ratio (2.64), closely followed by 150% RDF (2.63). Under 100% RDF, the lowest gross returns (Rs 56,527/ha), net returns (Rs 44,644/ha), and B:C ratio (2.43) were recorded. The application of nitrogen and phosphorus, which produced larger financial returns with increasing fertility levels compared to lower fertility, may be responsible for the improvement in economic returns. This is probably because improved nutrient availability promotes better crop growth and production, which raises productivity and profitability. Similar findings have also been reported by Daulagupu and Thakuria (2016) [2], as well as Jat *et al.* (2017) [6].

Table 2: Effect of genotypes and fertility levels on yield and economics of taramira

Treatments	Seed yield (kg/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
Taramira varieties				
V_1 - RTM 1624	1272	68706	51819	3.07
V_2 - T 27	1106	59718	42831	2.53
V_3 - RTM 314	1020	55068	38181	2.26
V_4 - RTM 1351	1129	60948	44061	2.61
V_5 - Filler	1052	56784	39897	2.36
CD at 5%	116.86	6311	6311	2.57
CV (%)	9.08	9.08	12.62	12.56
Fertility levels				
F_1 - 100 % RDF	1047	56527	44644	2.43
F_2 - 125 % RDF	1139	61531	45401	2.64
F_3 - 150 % RDF	1161	62676	45751	2.63
CD at 5%	60.24	3253	3253	0.19
CV (%)	7.17	7.18	9.96	9.95

Conclusion

The present study revealed that taramira genotype RTM 1624 was found to be most suitable as it recorded maximum seed yield and economic returns. Fertility levels significantly influenced crop performance, with 150% RDF producing the highest seed yield and economic returns, though it remained statistically comparable with 125% RDF in many parameters. The results indicated that increasing fertility up to 125–150% RDF improves productivity of taramira under semi-arid conditions. Overall, the study suggests that cultivation of high-yielding genotype RTM 1624 along with application of 125 % RDF is suitable for achieving higher productivity and profitability of taramira in the agro-climatic conditions of Jobner, Rajasthan.

Acknowledgement

The authors would like to thank ICAR-IIRMR, Sewar, Bharatpur (Rajasthan) for providing the necessary facilities and financial assistance to enable the research effort to be completed successfully.

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