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Effect of organic and foliar fertilization on growth parameters and yield of Taramira (*Eruca sativa* L.) under irrigated condition

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Abstract

The experiment was conducted during rabi *season of 2020 at the Campus for research and advanced studies Dhablan of the G.S.S.D.G.S. Khalsa College Patiala. A field experiment was laid out in randomized block design with 13 different treatments replicate thrice. The results revealed that significant increase in growth parameters and quality parameters were observed in T_{12} (6 % panchgavya solution + 5 % urea solution applied at 30, 60 and 90 DAS) which is stastically at par with T_{11} (2.5 % urea solution + 3 % urea solution applied at 30, 60 and 90 DAS). However, the attributes such as number of siliqua plant^{-1}, stover yield (q ha^{-1}), test weight (g) and harvest index (%) were found maximum in T_{12} (6 % panchgavya solution + 5 % urea solution applied at 30, 60 and 90 DAS) which is stastically at par with T_{11} (2.5 % urea solution + 3 % urea solution) while number of seeds siliqua^{-1}, seed yield (q ha^{-1}) , biological yield (q ha^{-1}) were stastically significant and reported maximum in T_{12} (6 % panchgavya solution + 5 % urea solution applied at 30, 60 and 90 DAS). However maximum gross return, net return and B: C ratio was recorded in T_{12} (6 % panchgavya solution + 5 % urea solution applied at 30, 60 and 90 DAS).*

Key word: Taramira, Organic manures, Foliar fertilization

Introduction

Taramira (*Eruca sativa* L.) is an important oilseed crop that is categorized as rapeseed and belongs to family Brassicaceae. It is an introduced crop in India and believed that it is native of South Europe and North Africa. It commonly known as rocket, true rocket and rocket salad. It contains 28% oil, 46.3% erucic acid as comparison to other rapeseed and mustard species while it also contains 12.4% linoleic acid, 28.7% oleic acid and 2.1% linolenic acid which are low as comparison to mustard oil. Saturated fatty acids are around 10.5% (Kumar and Ohisson 1988)

Taramira is herbaceous annual plant and cold season (*Rabi*) crop (Sown in whole October) Growing up to height of 2 to 4 feet and sown up to 4 to 5cm deep having chromosome number 2n=22 and it is cross pollinated crop. Flowers are bisexual and yellow to whitish in colour with deep violet veins. The fruit of taramira is known as siliqua which is cylindrical in shape and 2.5 cm in length. The seed of taramira is spherical or ovoid in shape having yellow brown or reddish in colour and having tap root system.

Medicinally the taramira oil pays a very important role for its therapeutic properties as an astringent, diuretic, digestive, emollient tonic, depurative, laxative, rubefacient and stimulant. The tender leaves detail to have stimulant, stomachic, diuretic and anticorbutic activity (Garg and Sharma 2014). The young plants and leaves used as salad, vegetable and also used as fodder for animals. The leaves also having pungent aroma and the pungency is due to the presence of isothiocyanates. In the Brassicaceae species glucosinolates is present which were found to have anti carcinogenic, antibacterial, antifungal and antioxidant properties.

Organic manures play a very important role in agriculture it improves the soil health without harming the environment. Organic manures adds the organic matter into the soil which improves the physical, chemical and biological properties of the soil such as water holding capacity, soil structure, soil pH, soil reaction, soil aeration, soil temperature, percolation and infiltration. Foliar spray is the application of fertilizers on the foliage of the crop as a spray solution. It is also called as non root feeding. But the foliar application is additional and it cannot replace the basal application and top dressing of the fertilizers. In foliar application low concentration of nutrient or fertilizer is applied and

application of foliar spray at initial and lateral stages of growth plays important role in the effective utilization of nutrients. The nutrients applied as foliar they can be applied single or also in combination of nutrients. Mainly the urea is applied, when urea is applied just before flowering or at flowering increases the grain quality. Foliar application also corrects the nutrient deficiency in crop and enhances the crop growth in some stages but also improves tolerance against adverse environmental conditions.

Materials and Methods

The experiment was conducted during *rabi*season of 2020 at the Campus for research and advanced studies Dhablan of the G.S.S.D.G.S. Khalsa College Patiala. A field experiment was laid out in randomized block design with 13 different treatments (T_0: Control, T_1: 10t FYM ha^{-1} T_2: 15t FYM ha^{-1}, T_3: 2t Poultry manure ha^{-1}, T_4: 4t Poultry manure ha^{-1}, T_5: 1t Vermicompost ha^{-1}, T_6: 2t Vermicompost ha^{-1}, T_7: 3% Panchgavya solution, T_8: 6% Panchgavya solution, T_9: 2.5% Urea solution, T_{10}: 5% Urea solution, T_{11}: 3% Panchgavya solution + 2.5% Urea solution, T_{12}: 6% Panchgavya solution + 5% Urea solution) replicate thrice. The plant height was observed and numbers of leaves were counted from the five randomly selected plants after this, values of these were averaged. To study the fresh and dry weight of five plants were collected from the sampling rows of each plot at 30 days interval from sowing till harvest of the crop. These fresh samples were air dried and then dried in an oven at 60^0C till a constant weight was obtained and weighed to record the average dry weight of the plant. The weight of the sun dried harvested crop was recorded from net plot area and expressed in quintal per hectare after subtracting the seed yield. Seed yield of each plot excluding the border and sampling row was weighed in kilo gram and converted into quintal per hectare.

Results and Discussion

At 30 DAS T_6 (2t vermicompost ha^{-1}) shows best results because it mineralized fast as compared to other organic manures and it provides nutrients readily available to plants so the plant height increases due to enhanced availability of nutrients (Table 1). At 60, 90 and at harvest the T_{12} gives maximum plant height because treatments are applied in two combinations (6% panchagavya solution + 5% urea solution). The panchgavya solution is also known to boost immunity and promote plant growth because the total microbial count and the physiochemical properties of the soil like EC, pH, micro and micro nutrients and quantity of phytohormons like indole acetic acid (IAA), abscisic acid, and gibberlic acid theses might helps in cell division and cell elongation that leads to increase plant height. Similar findings were also reported by Dubey *et al*. (2014) and Sinha *et al*. (2018) and *Gowda et al. (2018)*.

In general, panchgavya fertilization increased number of leaves $plant^{-1}$ significantly. At 30 DAS the number of leaves increase in T_6 because vermicompost is a formed from plant residues with the help of earthworm it makes the nutrient more readily available to the plants and also improves soil structure and pH of the soil which increases nutrient uptake in plants that leads to increase the number of leaves $plant^{-1}$ (Table 2). At 60, 90 DAS the number of leaves

Table 1: Effect of organic and foliar fertilization on plant height (cm) of taramira at 30, 60, 90 DAS and at harvest

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
T_0:Control	11.68	46.29	71.32	75.33
T_1:10 t FYM ha^{-1}	15.24	61.97	81.39	85.93
T_2:15 t FYM ha^{-1}	19.05	66.47	86.58	97.13
T_3:2t Poultry manure ha^{-1}	14.57	61.80	80.06	85.00
T_4:4 t Poultry manure ha^{-1}	16.27	62.57	84.30	87.43
T_5:1 t Vermicompost ha^{-1}	14.83	61.96	80.12	85.80
T_6:2 t Vermicompost ha^{-1}	19.56	64.33	82.81	88.43
T_7:3 % Panchgavya solution	14.48	59.89	78.73	84.40
T_8: 6 % Panchgavya solution	15.83	62.69	83.59	90.07
T_9: 2.5 % Urea solution	13.04	56.22	72.36	79.00
T_{10}: 5 % Urea solution	16.30	62.14	90.26	94.20
T_{11}: 3 % Panchgavya solution +2.5 % Urea solution	17.13	67.39	93.53	100.23
T_{12}: 6 % Panchgavya solution +5 % Urea solution	17.30	70.05	95.34	102.30
SE (±)	0.83	1.38	1.07	0.97
CD 5%	1.88	3.12	2.43	2.19

Note: All foliar spray applied at 20, 40 and 60 DAS.

Table 2: Effect of organic and foliar fertilization on number of leaves plant[1] of taramira at 30, 60, 90 DAS and at harvest

Treatments	Number of leaves plant^{-1}			
	30 DAS	60 DAS	90 DAS	At harvest
T_0	9.17	28.43	44.90	43.90
T_1	11.20	37.70	57.37	56.70
T_2	15.10	53.53	63.37	61.77
T_3	10.13	34.00	52.00	51.67
T_4	11.27	44.60	62.33	60.17
T_5	10.77	34.87	57.10	56.13
T_6	15.40	52.33	61.37	60.40
T_7	9.73	33.80	47.00	46.17
T_8	11.07	41.33	58.17	53.83
T_9	9.50	32.80	46.67	45.70
T_{10}	11.27	51.30	58.43	57.53
T_{11}	12.07	60.00	65.07	64.17
T_{12}	14.40	61.23	66.00	65.53
SE (±)	0.39	1.18	1.05	1.40
CD 5%	0.88	2.66	2.37	3.16

Note: All foliar spray applied at 20, 40 and 60 DAS

increases because panchgavya solution helps to increases the quantity of phytohormons such as indole acetic acid (IAA), abscisic acid, and gibberlic acid and urea solution helps increases the photosynthesis rate in plants when combined applied as foliar spray. Some amount of nutrients were also fall down on soil surface which improves the physical, chemical and biological properties of the soil which results more number of leaves. But at the time of harvest leaves were defoliated and number of leaves were reduced. Similar results were also reported by Dubey *et al*. (2020), Pegu *et al*. (2020) and *Gowda et al.* (2018).

In general, panchgavya fertilization increased fresh weight plant^{-1} significantly. The fresh weight is directly related to vegetative growth which is enhanced due to nitrogen, more the plant height, number of branches and leaves had more fresh weight of the plant (Table 3). Combined application of panchgavya and urea leads to increases the fresh weight plant^{-1} this is because panchgavya helps to enhance immunity and promote plant growth and increase the quantity of phytochemicals like indole acetic acid (IAA), abscisic acid, and gibberlic acid and urea also provide N to plants that is responsible to enhances the metabolic activities and photosynthesis in plants which leads to increases fresh weight of the plant. Nitrogen is the main constituent of chlorophyll, more the chlorophyll more the absorption of sunlight and increases the photosynthesis rate in plants. This findings also supported by Swain *et al*. (2020) and Meena *et al*. (2020) and Gowda *et al.* (2018).

Table 3: Effect of organic and foliar fertilization on fresh weight plant^{-1} (g) of taramira at 30, 60, 90 DAS and at harvest

Treatments	Fresh weight (g plant^{-1})			
	30 DAS	60 DAS	90 DAS	At harvest
T_0	4.30	17.73	116.83	132.03
T_1	6.73	25.00	126.87	141.90
T_2	9.27	34.10	143.77	158.30
T_3	5.87	23.30	121.60	135.67
T_4	7.30	31.33	127.43	142.83
T_5	6.30	23.53	126.00	139.20
T_6	9.97	26.33	129.43	142.00
T_7	5.73	23.00	120.43	133.83
T_8	7.20	23.50	127.60	142.13
T_9	5.10	19.63	117.93	132.30
T_{10}	7.50	31.20	129.43	143.50
T_{11}	7.97	34.67	145.83	160.87
T_{12}	8.30	36.77	147.70	162.37
SE (±)	0.37	0.99	0.90	0.73
CD 5%	0.85	2.25	2.03	1.64

Table 4: Effect of organic and foliar fertilization on dry weight plant^{-1} of taramira at 30, 60, 90 DAS and at harvest

Treatments	Dry weight (g plant^{-1})			
	30 DAS	60 DAS	90 DAS	At harvest
T_0	1.40	5.83	17.03	33.69
T_1	2.23	8.40	23.20	46.40
T_2	3.07	11.07	27.27	54.55
T_3	1.93	7.93	19.27	38.58
T_4	2.30	8.67	25.00	49.93
T_5	2.10	7.97	21.73	42.57
T_6	3.30	8.90	23.73	46.89
T_7	2.20	7.30	18.10	35.81
T_8	2.50	7.63	26.17	47.88
T_9	1.93	6.53	18.07	35.47
T_{10}	2.40	10.43	26.20	48.22
T_{11}	2.53	12.27	28.57	56.85
T_{12}	2.53	12.53	29.03	58.02
SE (±)	0.31	0.28	0.75	0.57
CD 5%	0.70	0.64	1.69	1.29

Note: All foliar spray applied at 20, 40 and 60 DAS

Dry weight is directly related to vegetative growth of the plant. Plants that were recorded more plant height, number of leaves, branches and fresh weight has been observed with more dry weight plant^{-1} (Table 4). The dry weight also related with photosynthesis, the plants that were founded with more vegetative growth parameters had more photosynthesis rate which leads to increases the dry

Table 5: Effect of organic and foliar fertilization on seed yield, stover yield and biological yield (q ha^{-1}) taramira

Treatments	Seed yield (q ha^{-1})	Stover yield (q ha^{-1})	Biological yield (q ha^{-1})
T_0	8.07	22.83	30.90
T_1	13.47	32.60	46.07
T_2	19.00	41.13	60.13
T_3	11.30	30.13	41.43
T_4	13.53	34.87	48.40
T_5	13.13	31.33	44.47
T_6	17.77	41.87	59.63
T_7	9.73	24.30	34.03
T_8	14.77	35.03	49.80
T_9	8.73	23.80	32.53
T_{10}	15.43	41.60	57.03
T_{11}	19.47	42.20	61.67
T_{12}	22.27	43.87	66.13
SE (±)	0.55	0.86	1.11
CD 5%	1.25	1.95	2.51

Note: All foliar spray applied at 20, 40 and 60 DAS

matter accumulation in plants. Similar results were also founded by Bisht *et al*. (2018) and Pegu *et al*. (2020) and Gowda *et al*. (2018).

The highest seed and stover yield and biological yield were recorded with the 6 % panchgavya solution + 5% urea solution. The higher seed yield may be due to higher recorded more number of siliqua $plant^{-1}$ and number of seeds $siliqua^{-1}$ and test weight which was significantly superior to the other treatments which ultimately contributed to obtain higher seed yield (Table 5 and fig. 1). This finding is also supported by Dubey *et al*. (2014), Pegu *et al*. (2020) *and Gowda et al*. (2018).

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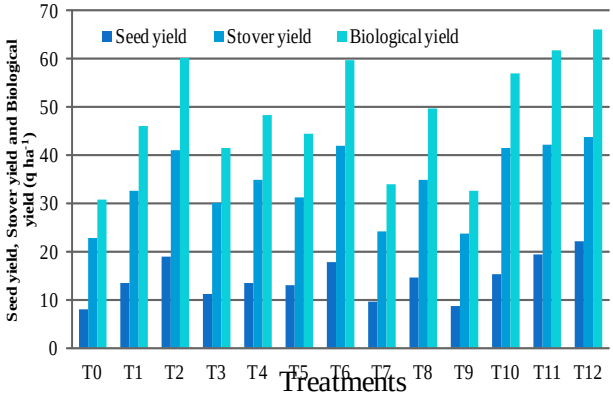

Fig. 1: Effect of organic and foliar fertilization on seed yield, stover yield and biological yield (q ha^{-1}) of taramira

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