

Original Research Article

<https://doi.org/10.20546/ijcmas.2019.812.082>

Economics and Yield Affected by Herbal Extracts in Indian Mustard (*Brassica juncea* L.)

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ABSTRACT

The present investigation was carried out during winter season of 2016-17 at ICAR-Directorate of Rapeseed and Mustard Research, Bharatpur, Rajasthan to evaluate the effect of herbal extracts on growth, economic feasibility, yield and yield attributes of Indian mustard (*Brassica juncea* L.). The experiment was laid out in randomized block design with four treatments and five replications, viz. herbal extracts, RDF + one irrigation, RDF + KNO₃ spray and Control. Results revealed that maximum plant leaves (49.6), GMR (₹ 92423), NMR (₹ 61148) and B:C ratio (2.96) had with treatment receiving RDF + one irrigation. The yield and yield attributes; main shoot length (86.3cm), seed weight/plant (44.06 g), dry weight/plant (158.29g) and yield (2640 kg/ha) were highest under the treatment of RDF+ one irrigation as compared to other treatments. This study indicated that application of recommended dose of fertilizers with one irrigation at 65 days after sowing was more beneficial in terms of getting higher yield and economic returns in climatic conditions of Rajasthan.

Keywords

Economics,
Mustard, Irrigation,
Herbal extract,
Yield

Article Info

Accepted:
07 November 2019
Available Online:
10 December 2019

Introduction

Indian mustard is a Rabi crop that required relatively cool temperature, a fair supply of soil moisture during its growing season and a dry period during harvest. Indian mustard is predominantly cultivated in Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh and

Gujarat it is also grown under some non-traditional area of south India including Karnataka, Tamil Nadu and Andhra Pradesh. It is cultivated both under irrigated (79.2%) and rain fed (20.8%) condition. Being more responsive to fertilizers, gives better return under irrigation condition. Use of organic manure not only helps to sustain crop yield but

also plays a key role by exhibiting both direct as well as indirect influence on the nutrients availability in soil by improving the physical chemical and biological properties of soil (Singh and Biswas, 2000; Meena *et al.*, 2018).

Among the organic farming practices use of herbal extract or plant extract or botanicals is the emerging concept. Many types of extract from different plant are use for numerous purposes. The utilization of plant extract have been revealed to be eco-friendly and efficient against many plant pathogen. Unlike the chemical farm inputs, extract derived from plants are biodegradable, non-toxic, non-polluting and non-hazardous to humans, animals and birds.

Herbal extracts from different plants like *Terminalia chebula*, *Termenila belerrica*, *Terminalia arjuna*, *Ocimum sanctum*, *Azdrichta indica*, *Curcuma longa* etc. have been used in various crops as plant growth regulator or plant growth inhibitor. Neem (*Azdrichta indica*) is considered as the magical tree and hundreds of its active compounds are used in plant protection, neem pest fumigant, neem fertilizer, neem manure, neem compost, neem urea coating agent and neem soil conditioner.

Being a rainfed crop, nutrient management is little or non-existent leading to poor productivity. Site-specific nutrient management, optimum crop geometry, balanced NPK nutrition, management of natural resources, integrated approach to plant-water, nutrient and pest management and extension of rapeseed-mustard cultivation to newer areas under different cropping systems will play a key role in further increasing and stabilizing the productivity and production of rapeseed-mustard to meet out the 39 million tones of vegetable oil requirement in the country by 2050 AD. The present study was undertaken to investigate the effect of herbal extract vis-a-vis chemical fertilizers and

irrigation on economics and yield of Indian mustard.

Materials and Methods

Experimental site and climate characteristics

The experiment was conducted during 2016-17 at research farm, ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur located at 77°30' E longitude, 27°15' N latitude and at an altitude of 178.37 meter above mean sea level. The region falls under Agro climatic Zone III a (semi-arid Eastern plain) with sub-tropical and semi-arid climate.

The climate of this zone is typically semi-arid, characterized with wide range of temperature between summer and winter. High temperature with high wind velocity during summers and low temperature during winters are the characteristic features of climatic condition.

The mean monthly meteorological observations recorded at ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur during the crop growth period. The mean weekly maximum and minimum temperature during the crop growing seasons of mustard fluctuated between 18.3 to 40.9 °C and 3.5 to 22.1 °C.

The mean daily evaporation from USWB class a pan evaporimeter ranged from 1.0 to 9.7 mm per day. The average relative humidity fluctuated between 20.4 to 57.8 percent at noon. The bright sunshine hours varied from 5.9 in January to 9.3 in April. Rainfall received during 2016-17 was 55.8 mm.

Soil characteristics

The soil samples were collected from surface soil (0-15cm) and analyzed for soil physico-chemical properties with the help of standard

methods. The experimental site was silty clay loam in texture (19.2% sand, 51.3% silt and 29.4% clay), pH (1:2 soil water suspension) 8.3, bulk density 1.52 g cm³, field capacity (by weight) 12.5 % and permanent wilting point was observed at 2.35%. The nutrient concentration in soil was also measured 0.24%, 126.3 kg/ha, 17.23 kg/ha, 149.3 kg/ha organic C, available N, available P and available K, respectively.

Treatment details and preparation of field

The experiment consisted of four treatments, viz. herbal extracts, RDF+one irrigation, RDF+KNO₃ spray and Control. The herbal extract was prepared using ecotypic vegetations based on traditional knowledge. The variety RH 406 was used as test crop. Mustard was cultivated as per the recommended package and practices of agronomy.

The crop was harvested at 80 per cent silique turned down yellowish brown. The plants from each net plot area (28 m × 4.5 m) were harvested carefully and seed yield from each plot was recorded.

Observation recorded

Observations on growth, yield attributing characters, economic parameters and yield were recorded. The data obtained on various observations were tabulated and analyzed factorial randomized block design with three replications by using the techniques of the analysis of variance (ANOVA) as suggested by Panse and Sukhatme (1967) and the treatment was tested by F test shown their significance where critical difference (CD) at 5% level of significance was determined for each character to compared the differences among treatment means.

Results and Discussion

Number of leaf (plant⁻¹)

Number of leaf (plant⁻¹) at different stages of plant growth (DAS) as influenced by application of different various treatments (Table 1). Number of leaf (plant⁻¹) was found significantly higher with treatment T₂ followed by T₃ at different stages of plant growth 45, 60 and 90 DAS.

Main shoot length (cm)

The data pertaining to main shoot length (cm) as influenced by various treatment is given in Table 2. Among various treatments the significantly higher main shoot length was recorded with T₂ which was at par with T₃. Least main shoot length was found in T₄ (81.24).

Seed weight/plant (g)

The data on seed weight/plant (g) as influenced by various treatments. Highest seed weight/plant was recorded in treatment T₂ which was at par with treatment T₃. However least seed weight/plant was recorded in T₄ (34.75 g). Similar findings were also reported by Kingra and Kaur (2012).

Dry weight/plant (g)

The data on dry weight/plant (g) as influenced by various treatments is given in Table 2. Treatment T₂ recorded the highest dry weight /plant (158.29 g) followed by T₃, T₁ and T₄ treatment. Similar findings were also reported by Mandal *et al.*, (2000), Paliwal and Singh (2014).

Seed yield (kg/ha)

The data pertaining to yield (kg/ha) as influenced by various treatment is given in

Table 3. Treatment of T₂ produced highest seed yield (2640.68 kg/ha) which was found at par with T₃ treatment (2501.7 kg/ha). The least yield was recorded in T₄ (control) treatment *i.e.* 1469.24 kg/ha. The significantly highest seed yield of mustard under the treatment of T₂ was observed due to significant improvement in yield attributes. These results corroborate the findings of Panda (2000), Bhalerao (2001), Singh *et al.*, (2002), Abraham (2010).

Economic viability of treatments

The determination of economic indices like cost of cultivation, gross monetary returns (GMR), net monetary returns and B: C ratio is the most important parameters to evaluate the effect of the treatments for practical purpose particularly from farmers as well as planner point of view. The farmers mainly interested to earn more profit per unit area, per unit time and investment. The cost of cultivation of Mustard is more that can be judged from common expenditure of Rs 28275/ha. Maximum investment of Rs 31275/ha was needed to grow mustard crop with T₂, while minimum investment of Rs 26275/ha was incurred under the treatment consisted with T₄. The related work was done by Poornima *et al.*, (2010). The GMR is directly related to price rate of produce in the market and total production realized under a particular treatment. The GMR was highest (Rs 92423/ha) under the treatment consisted with T₂, while the treatment associated with lower T₄ fetched the lowest GMR (Rs 51423/ha). The related work was done by Poornima *et al.*, (2010).

The NMR is the actual profit gained by the farmers as it is determined by deducting the cost of cultivation under a particular treatment from the GMR of the

same treatment. It is obvious that NMR increased by increasing various treatment. Consequently, treatment consisted with T₂, record the highest NMR (61148.8 Rs/ha) which was closely followed by T₃ (56484.5 Rs/ha). While other treatments fetched lesser NMR, the lowest (51423.4 Rs/ha) NMR was found in T₄. These findings closely related with Ram *et al.*, (2008) and Biswas *et al.*, (2009). The treatment combination T₂ attained the maximum value of GMR and NMR closely followed by T₃ due to higher seed yield coupled with lesser cost of cultivation over other combinations. B:C ratio is also termed as profitability. It is a true monetary gain over each rupee of investment under a particular treatment. In other words, it is the ratio of profit over every rupee of investment and it was calculated by dividing the GMR of a particular treatment by the cost of cultivation under the same treatment. The B:C ratio was maximum (2.96) with the treatments T₂ While the lowest B:C ratio (1.96) was calculated under the treatment T₄ due to proportionate increase in profit with each rupee of investment. The similar findings were done by Saleem *et al.*, (2001).

Mustard is a one of the important oilseed crop in India. Its production is much influenced by the application of fertilizers and irrigation. Maximum main shoot length, seed weight/plant, dry weight/plant, seed yield, gross monetary returns, net monetary returns and B:C ratio was recorded highest with treatment receiving recommended dose of fertilizers N:P:K:S:Zn:B (80:40:40:5:1) along with one irrigation at 65 DAS. On the basis of our finding, it can be concluded that recommended dose of fertilizers with one irrigation is beneficial for getting maximum seed yield and economic returns of Indian mustard in the present ecology.

Table.1 Effect of different treatments on number of leaf (plant⁻¹) at different stages of plant growth (DAS)

Treatments	Number of leaf (DAS)		
	45	60	90
HERBAL (T₁)	14.82	31.73	43.2
RDF+one irrigation (T₂)	16.33	36.76	49.6
RDF+KNO₃ Spray (T₃)	15.53	33.83	48.83
Control (T₄)	13.34	30.16	42.93
CD (P=0.05)	1.02	4.37	NS
SEm±	0.386	1.477	1.881

Table.2 Effect of different treatments on yield and yield attributes

Treatments	Main shoot length (cm)	Seed weight / Plant (gm)	Dry weight / plant	Seed yield (kg/ha)
HERBAL (T₁)	82.53	37.43	144.66	2231.02
RDF+one irrigation (T₂)	86.33	44.06	158.29	2640.68
RDF+KNO₃ Spray (T₃)	84.82	41.34	157.34	2501.7
Control (T₄)	81.24	34.75	122.21	1469.24
CD (P=0.05)	7.84	14.08	53.97	521.58
SEm±	2.631	4.57	16.747	171.787

Table.3 Economics of the treatment under various treatments

Treatments	Cost of Cultivation	GMR	NMR	B:C Ratio
HERBAL (T₁)	28275	78085.7	49810.7	2.76
RDF+one irrigation (T₂)	31275	92423.8	61148.8	2.96
RDF+KNO₃ Spray (T₃)	31075	87559.5	56484.5	2.82
Control (T₄)	26275	51423.4	25148.4	1.96

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How to cite this article:

Manish Meena, Har Vir Singh, R.S. Jat, G.L. Yadav, M.L. Dotaniya, M.D. Meena, R.L. Choudhary and Meena, M.K. 2019. Economics and Yield Affected by Herbal Extracts in Indian Mustard (*Brassica juncea* L.). *Int.J.Curr.Microbiol.App.Sci*. 8(12): 628-633.
doi: <https://doi.org/10.20546/ijcmas.2019.812.082>