



Effect of Mulching and Sulphur on Growth and Yield of Yellow Mustard (*Sinapis alba*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study was conducted at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P) in *Rabi*, 2021 to study the Effect of Mulching and Sulphur on Growth and Yield of Yellow Mustard (*Sinapis alba*). It was consisting of combination of three types of Mulching No mulch, Paddy straw and Poly sheet mulch and three Sulphur levels (20kg S/ha, 40 kg S/ha and 60 kg S/ha). The study was laid out in Randomized Block Design with nine treatments each replicated thrice. The experimental results revealed that the growth parameters and yield parameters such as plant height (145.94 cm), dry weight (34.30 g), number of branches/plant (11.58), number of seeds/siliquae (37.41) and test weight (3.08 g) at harvest, significantly recorded in treatment T₉ with the application of Poly sheet mulch+60 kg S/ha. Moreover, seed yield (1.82 t/ha), stover yield (3.94 t/ha), gross return (95,762.64 INR/ha), net return (52,487.44 INR/ha) and B:C ratio (2.21) were also recorded significantly higher in the treatment which is Poly sheet mulch + Sulphur 60 kg/ha among all treatments.

Keywords: *Mulching; Sulphur; yellow mustard; growth and yield.*

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1. INTRODUCTION

In present era oil seed crops form the main source of energy for major portion of Indian population due to less availability of animal fat and its ill effect on heart. Among the rapeseed and mustard group, yellow sarson which belongs to family Brassicaceae is an important crop in terms of its high seed oil and protein content. value. In India, about 27.5 million ha area is occupied by oilseeds which represent 14 per cent of the total cropped area with the production of 24.72 million tonnes accounting for 5 per cent of gross national product and 10 per cent value of all agricultural commodities [1]. India mustard is predominantly cultivated in the states of Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh, and Gujarat. Rajasthan ranks first in area and production of rapeseed and mustard with 2.50 million ha area and 3.71 million tonnes production. Mustard oil is used as condiment in pickles, flavoring curries and vegetables, preparation of hair oils, medicines, soap making and in the tanning industry for softening of leather. The mustard cake is used mostly for cattle feed and manure [2].

One of the common practices to reduce evaporation loss from the soil and prolonging the availability of moisture to the crop is the use of mulches. Mulching increases soil moisture, regulates soil temperature, suppresses weed growth, minimized leaching loss of nutrients, checks excessive evaporation, reduces soil erosion, improves production and quality. Thus, mulching economises the use of irrigation or rainwater and boosts nutrient use efficiency by conserving more water in the crop rhizosphere. The effects of mulch on soil temperature, moisture regime and root growth as well as yield depend on the micro-environment, made of mulch application and quality and quantity of mulch materials [3]. Mulch increased soil organic matter and soil moisture contents but decreased bulk density and soil strength compared to control. The effects of mulch on soil temperature, moisture regime and root growth as well as yield depend on the micro-environment, made of mulch application and quality and quantity of mulch materials. Keeping in view these circumstances, it was contemplated to work out the suitable tillage and mulching practices for taking the higher yield of mustard in rainfed condition. The poly sheet can be used in moisture deficit areas. The polythene mulch is easily available in the

market and its use in agriculture is eco-friendly as after use, poly sheets may be collected from the crop field and can be well mixed with coltar during construction of pucca roads. If black polyethylene is used for the purpose, it prevents entry of light to the soil surface thus restricting any possible growth of weed, which is a menace in rainfed agriculture.

In oilseed, sulphur plays a vital role in quality, production and plays an important role in protein synthesis of essential amino acids like cysteine and methionine. However, the information regarding optimum dose of sulphur and its influence on mustard is necessary to augment the productivity and quality of Indian mustard. Sulphur levels significantly influenced the seed and Stover yield of mustard [4]. The chemical fertilizers being used for supplementing the major nutrient are generally either deficient or low in sulphur content. Therefore, present study was taken to investigate the Effect of Mulching and Sulphur on Growth and Yield of Yellow mustard (*Sinapis alba*).

2. MATERIALS AND METHODS

The present examination was carried out during *Rabi*, 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, UP, India which is located at 25.28°N latitude, 81.54°E longitude and 98 m altitude above the mean sea level. The soil of the experimental field constituting a part of central Gangetic alluvium is neutral and deep. Pre-sowing soil samples were taken from a depth of 15 cm with the help of an auger. The composite samples were used for the chemical and mechanical analysis. The soil was sandy loam in texture, low in organic carbon and medium in available nitrogen, phosphorus and low in potassium. The mechanical, chemical, and physio-chemical properties of the soil of experimental field, and the methods used, are presented in Table 1 and 2.

The experiment laid out in Randomized Block Design which consisting of nine treatments with No Mulch + Sulphur 20 kg/ha, Paddy straw mulch + Sulphur 40 kg/ha, Poly sheet mulch + Sulphur 60 kg/ha, No Mulch + Sulphur 20 kg/ha, Paddy straw mulch + Sulphur 40 kg/ha, Poly sheet mulch + Sulphur 60 kg/ha, No mulch + Sulphur 20 kg/ha, Paddy straw mulch + Sulphur 40 kg/ha, Poly sheet mulch + Sulphur 60 kg/ha. The date of sowing was October 10th, 2021. Seeds were sown in Line

Table 1. Mechanical analysis of the soil of experimental field

Mineral fraction	Value (%)	Method
Sand (%)	60%	International Pipette Method
Silt (%)	20%	
Clay (%)	14.4%	
Textural class	Sandy Loam	USDA Triangle

Table 2. Chemical analysis of soil at pre-experimental stage

Parameter	Value	Method
Organic carbon	0.57%	Walkley and Black Method
Available Nitrogen	230 Kg/ha	Alkaline Permanganate Method
Available Phosphorus	32.10 Kg/ha	Olsen's Colorimetric Method
Available Potassium	346 Kg/ha	Flame photometer method
pH	7.3	lass electrode pH meter
EC	0.29 (d/Sm)	Method No. 4, USDA Handbook No. 60

sowing method, The Recommended Dose of Fertilizer (80:40:40 NPK kg/ha) will be applied, as Half dose of Nitrogen along with full dose of Phosphorus, Potassium and Sulphur as basal and remaining half dose of Nitrogen after 30 Days of Sowing (DAS). Flood irrigation was provided to experimental field. Total rainfall received during experimental trial was 1.7mm. The observations recorded on different growth parameters at harvest viz, plant height (cm), number of branches per plant, Plant dry weight, number of siliques per plant, number of seeds per silique, test weight, grain yield and stover yield and harvest index were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design [5].

3. RESULTS AND DISCUSSION

Growth Attributes: As can be seen in Table.3, growth parameters are summarized statistically. At 100 DAS, significantly taller plant height (145.94 cm) was recorded with Poly sheet mulch + Sulphur 60 kg /ha. However, *Paddy straw mulch + Sulphur 60 kg/ ha*, *Poly sheet mulch + Sulphur 40 kg/ ha* was statistically at par with *Paddy straw mulch + Sulphur 60 kg/ ha*. The minimum plant height was recorded in the treatment combination of No mulch + Sulphur 20 kg/ha which is 128.52 cm. Significantly maximum Number of branches (11.69) was recorded with application of *Paddy straw mulch + Sulphur 60 kg/ ha*. However, *Poly sheet mulch + Sulphur 60 kg/ ha* was statistically at par with *Poly sheet mulch + Sulphur 60 kg/ ha*. The minimum number of branches was recorded in the treatment combination of No mulch + Sulphur 20 kg/ha

which is 9.01 g. Significantly maximum plant dry weight (34.30 g) was recorded in the treatment combination *Poly sheet mulch + Sulphur 60 kg/ ha*. However, *Paddy straw mulch + Sulphur 60 kg/ ha*, *Poly sheet mulch + Sulphur 40 kg/ ha* was statistically at par with *Paddy straw mulch + Sulphur 60 kg/ ha*. The results demonstrates that overall improvement in growth character of plant owing of sulphur application were known sulphur enhance cell multiplication, elongation and expansion, imparts a deep colour to leaves due to better chlorophyll synthesis resulting in greater amount of dry matter in comparison to sulphur deficient plant. This argument was also supported by Singh and Meena [6], Mishra (2001), Nepalia and Jain [7]. Raut et al., [8] work from Akola observed that application of Sulphur 40 kg/ha resulted in the highest dry matter production.

Yield Attributes: As can be seen in Table.4, yield parameters are summarized statistically. At the time of harvest, significantly length of silique (8.02 cm) was recorded with *Paddy straw mulch + Sulphur 60 kg/ha*. However, *Poly sheet mulch + Sulphur 40 kg/ ha*, *Poly sheet mulch + Sulphur 60 kg/ ha* was statistically at par with *Paddy straw mulch + Sulphur 60 kg/ ha*. The minimum length of silique was recorded in the treatment combination of No mulch + Sulphur 20 kg/ha which is (6.10). Significantly maximum Number of seeds per silique (37.41) was recorded with application of *Poly sheet mulch + Sulphur 60 kg/ ha*. However, *Paddy straw mulch + Sulphur 60 kg/ ha* was statistically at par with *Poly sheet mulch + Sulphur 60 kg/ ha*. The minimum number of seeds per silique was recorded in the treatment combination of No mulch + Sulphur 20 kg/ha

Table 3. Effect of Mulching and Sulphur on growth attributes of Yellow Mustard

Treatment combination	At 100DAS		
	Plant Height (cm)	Number of Branches per plant	Plant dry weight (g/plant)
1-No mulch + sulphur 20 kg / ha	128.52	9.01	22.74
2-Paddy straw mulch+ sulphur 20kg ha	135.23	9.21	26.25
3-Polysheet mulch + sulphur 20 kg / ha	132.79	9.17	24.39
4- No mulch + sulphur 40 kg / ha	138.04	9.70	28.43
5-Paddy straw mulch +sulphur 40 kg/ ha	143.18	10.75	32.11
6-Poly sheet mulch + sulphur 40 kg/ ha	143.62	10.93	30.18
7- No mulch + sulphur 60 kg/ ha	141.50	9.88	31.56
8-Paddy straw mulch + sulphur 60kg/ha	144.38	11.69	33.12
9-Polysheet mulch + sulphur 60 kg/ ha	145.94	11.58	34.30
F-Test	S	S	S
SEm (\pm)	2.29	0.63	1.13
CD (5%)	6.88	1.89	3.40

Table 4. Effect of Mulching and sulphur on yield attributes of Yellow Mustard

Treatment combination	At Harvest					
	Length of silique	No. of Seeds/silique	Test weight (g)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest Index (%)
1	6.10	27.07	2.13	1.13	2.71	32.22
2	7.46	29.19	2.31	1.32	2.95	41.19
3	7.56	28.45	2.26	1.21	2.86	33.15
4	6.51	30.14	2.49	1.40	3.17	35.99
5	7.63	34.22	2.84	1.68	3.72	40.78
6	7.78	33.73	2.72	1.54	3.61	35.48
7	6.98	32.68	2.56	1.49	3.32	33.41
8	8.02	35.16	2.97	1.71	3.83	35.85
9	7.78	37.41	3.08	1.82	3.94	37.68
F-Test	S	S	NS	S	S	S
SEm (\pm)	0.35	1.32	0.27	0.06	0.04	1.94
CD (5%)	1.04	3.95	0.80	0.17	0.12	5.80

which is (27.07). Significantly maximum test weight (3.08 g) was recorded in the treatment combination *Poly sheet mulch + Sulphur 60 kg/ ha*. However, *Paddy straw mulch + Sulphur 60 kg/ ha*. However, *Paddy straw mulch + Sulphur 60 kg/ ha*, *Poly sheet mulch + Sulphur 40 kg/ ha* was statistically at par with *Paddy straw mulch + Sulphur 60 kg/ ha*. The minimum test weight was recorded in the treatment combination of No mulch + Sulphur 20 kg/ha which is (2.13 g). Significantly maximum grain yield (1.82 t) was recorded in the treatment combination *Poly sheet mulch + Sulphur 60 kg/ ha*. However, *Paddy straw mulch + Sulphur 60 kg/ ha*, *Poly sheet mulch + Sulphur 40 kg/ ha* was statistically at par with *Paddy straw mulch + Sulphur 60 kg/ ha*. The minimum grain yield was recorded in the treatment combination of No mulch + Sulphur 20 kg/ha which is (1.13 t). Significantly maximum stover yield (3.94 t) was

recorded in the treatment combination *Poly sheet mulch + Sulphur 60 kg/ ha*. However, *Paddy straw mulch + Sulphur 60 kg/ ha*, *Poly sheet mulch + Sulphur 40 kg/ ha* was statistically at par with *Paddy straw mulch + Sulphur 60 kg/ ha*. The minimum stover yield was recorded in the treatment combination of No mulch + Sulphur 20 kg/ha which is (1.71 t). Significantly maximum harvest index % (37.68) was recorded in the treatment combination *Poly sheet mulch + Sulphur 60 kg/ ha*. However, *Paddy straw mulch + Sulphur 60 kg/ ha*, *Poly sheet mulch + Sulphur 40 kg/ ha* was statistically at par with *Paddy straw mulch + Sulphur 60 kg/ ha*. The minimum harvest index was recorded in the treatment combination of No mulch + Sulphur 20 kg/ha which is (32.22 %). The results demonstrates that Chauhan et al. [9] observed at Gurgaon that application of

Sulphur application of 20 and 40 kg S/ha improved the seed yield significantly, indicating 46.7% and 63.4% increase over the control due to significant increase in the yield attributing characters such as number and length of siliquae, seeds siliquae 1000-seed weight. Almost similar trends were observed for straw or stalk and biological yield Highest harvest index (24.4%) was recorded at 20 kg S/ha. Jat et al., [10] reported that application of 30 kg S/ha has significantly increased the number silique/plant, test weight, seed yield and Stover yield of mustard. Tomar et al., [11] reported that significant higher yield of mustard at farmers field by using Sulphur at different doses viz. 20, 30 and 40 kg S/ha. Parihar et al., [12] reported that progressive increase in levels of Sulphur from control to 30 kg/ha resulted significant improvement in the seed yield 15.89 q/ha that was 8.9 and 24.02% higher than 20 kg/ha and control. Jyoti et al., [13] reported that under the application of 30 kg S/ha resulting in a 41.9% and 18.9% increase in the yield over that of the control. Tiwari et al [14] also reported that significant higher yield of mustard at farmers field by using Sulphur at different doses viz. 20, 30 and 40 kg S/ha.

4. CONCLUSION

It is concluded that, that for obtaining higher yield in yellow mustard during Rabi season, the treatment combination with the application of Poly sheet mulch + Sulphur 60 kg/ha was found more productive with maximum net returns. Combined treatment of Poly sheet mulch + Sulphur 60 kg/ha is very effective and can be used by the farmers as it gives good yield.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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