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

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 T_9 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.*

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 **(Anonymous, 2015)**. 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 **(Potdar *et al.,* 2019).**

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 (**Manoj *et al.,* 2014**). 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 (**Sharma *et al.,* 2008**). 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*).

MATERIALS AND METHOD

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^{o}N latitude, 81.54^{o}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.

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

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 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 recieved 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 **(Gomez and Gomez 1984).**

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 comparision to sulphur deficient plant. This argument was also supported by **Singh and Meena (2004) [14], Mishra (2001), Nepalia and Jain (2000)**. **Raut *et al.,* (1999**) 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 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, 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.* (2002)** 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.,* (2008)** 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.,* (2007**) 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.,* (2014)** 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.,* (2012)** 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* (2003)** 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.

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 dry weight

		plant	(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 (±)	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 (±)	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

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 OF INTEREST

Authors have declared that no competing interests exit.

REFERENCES

1. Anonymous, Economic Survey 2014-15 Volume II. Economic Division, Department of Economic Affairs, Ministry of Finance, Government of India 2015.
2. Potdar, D. S., Purohit, H. S., Meena, R. H., Kaushik, M. K., Jain, H. K. and Ameta, K. D. Effect of integrated phosphorus management on growth, yield and quality of mustard (*Brassica juncea* L.). *Journal of Pharmacognosy and Phytochemist***8**(4): 1700-1704;2019.
3. Manoj, K.S., Yashwant, K.S., Meena, R.A., Parvesh, K., Rajput, B.S. and Triyugi, N. Effect of tillage and mulch in mustard crop under rainfed conditions. International Journal of Tropical Agriculture, 32:1-2;2014.
4. Sharma, Y.K. Effect of phosphorus and sulphur on yield and uptake of nutrient by mustard. *Annuals of Plant Soil Research*. **10**(2):195-196;2008.

5. Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd Edition (IRRI). John Wiley and Sons, New York, Chichester, Brisbane, Toronto and Singapore, 1984
6. Singh, A. and Meena, N.L. Effect of nitrogen and Sulphur on growth, yield attributes and seed yield of mustard (*Brassica juncea*) in eastern plains of Rajasthan. *Indian Journal of Agronomy*, **49**(3):186-188;2004.
7. Nepalia V, Jain GL. Effect of weed control and sulphur on yield of Indian mustard (Brassica juncea L.) and their residual effect on summer green gram (Phaseolus radiatus). Indian journal of Agronomy; 45:483-488;2000.
8. Raut, R.F., Hamid, A., Hadole. S.S., Jeughale, G.S. and Mohammed, S. (1999). Dry matter and grain yield of mustard as influence by irrigation and Sulphur levels. Annals Plant Physiology, 13(2):118-122,1999.
9. Chauhan, D.R., Ram, M. and Singh, I. Response of Indian mustard (*Brussicu juncea*) to irrigation and fertilization with various sources and levels of Sulphur. *Indian Journal of Agronomy*, **47**(3):422-426;2002.
10. Jat, G; Sharma, K.K; Kumawat, B.L. and Bairwa, F.C. Effect of FYM and mineral nutrients on yield attributes yields and net return of mustard. Ann. PI. Soil Res., 10(1); 92-95;(2008).
11. Tomar, S.K. and Singh, K. (2007). Response of Indian mustard to nitrogen and Sulphur fertilization under rainfed condition of Diara land. *International Journal of Agricultural Science*. 3(2):5-9.
12. Parihar, S., Kameriya, P.R. and Choudary, R. (2014). Response of mustard (Brassica juncea) to varying levels of Sulphur and fortified vermicompost under loamy sand soil. Agriculture Science Digest. 34(4):296-298.
13. Jyothi K., Naik S., Mandal .and Das, D. k., (2012)**.** Performance of different sources of Sulphur on yield and quality of rapeseed (*Brassica compestris* L.). *Journal of Indian Society of Soil Sciences* **21**(2):167-172.
14. Tiwari, R.C., Kumar, S. and Singh, D.P. (2003). Sulphur status of soil and crops Fertilizer News, 48(8):35-38.