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Response of sesame (*Sesamum Indicum* l.) to non-chemical weed management practices in summer season of Nagaland

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ABSTRACT

A field experiment entitled "Response of sesame (Sesamum indicum L.) to non-chemical weed management practices in summer season under rainfed conditions of Nagaland" was carried out at the Agronomy research farm, School of Agricultural Sciences, Nagaland University, Medziphema campus, during the summer season of 2021. The experiment was conducted in a randomized block design (RBD) with three replications and eight treatments, viz. weedy check, Hand weeding at 20 and 40 DAS, Cardboard mulching, Paddy straw mulching @5tha^{-1}, Farmer's practice, Wood chips mulching @5tha^{-1}, Live mulch with a legume (black gram) and FYM mulching @10tha^{-1}. The result showed that the weed dynamics were significantly affected, with wood chip mulching @5tha^{-1} having the lowest weed dry weight of (3.03g, 6.62g) @25, and 50 DAS and the highest WCE of (87.18% and 79.34%) respectively. Among the non-chemical weed management, cardboard mulching had higher growth (136.33 cm plant height) and yield (634.58 kg/ha seed yield). T_3 (cardboard mulching) also recorded the highest net returns of ₹27408 with a B: C of 1.33.

Keywords: Mulching, Sesame, Woodchips

INTRODUCTION

Sesame (*Sesamum indicum* L.) or Gingelly, also known as Til, is one of India's most important edible oilseeds. Sesame usually ranks first for having the highest oil content, about 46-52% and its protein content varies from 18-20%. It is also called 'Queen of oil seed crop' because of its quality oil (Srikanth *et al.,* 2023). In India, Sesame is grown in all crop growing seasons i.e. *kharif*, late *kharif*, *rabi*, and summer (Jamir *et al.,* 2019). Weeds cause serious damage to most crops due to their competition with the crops for light, nutrients, moisture and space, which leads to enormous reductions in crop yields. During the first four weeks of the growth period, sesame has low growth rate resulting in low competitive ability against weeds due to which sesame needs a critical weed-free period of up to 50 days of planting. Uncontrolled weed growth resulted upto 50%-74% yield reduction (Azimi *et al.,* 2023). The application of herbicides to control weeds has been a major factor enabling the intensification of agriculture. However, the excessive use of herbicide increases the herbicide resistance in weeds. In addition to the high cost of chemical weed control, there is also an extensive concern about adverse environmental effects. To avoid the above problems, various non-chemical weed management approaches have been suggested, which are cheap, easy and also play a great role in minimizing the adverse environmental effects. One such approach is mulching, which evidently has a great potential to suppress weeds and is readily applicable to the fields. It also possesses other advantages like nutrient recycling and control of soil erosion (Bharathi *et al.,* 2021). Mulches are any materials ranging from organic plant residues to inorganic plastic mulch that act as a physical barrier to resources that weeds depend on for germination, growth, and development, such as water and sunlight. It has been reported that plastic mulch materials are more effective but organic mulch materials are inexpensive and environment friendly (Kalita *et al.,* 2022). It can also regulate and improve the physical, chemical, and biological properties of the soil (Ravichandran *et al.* 2022). Therefore, a trial consisting of eight different treatments using different approaches of non-chemical weed management practices was conducted to evaluate its performance during the summer season of Nagaland.

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MATERIALS AND METHOD

A field experiment was carried out during the summer season (April- July) of 2021 at Medziphema (25˚45´43´´N latitude and 95°53´04´ longitude). The soil in the experimental site was clayey loam soil which was acidic in reaction, with high organic carbon availability (1.34 %), Medium in available N (242 kgha^{-1}), P (16.8 kg ha^{-1}) and K (178.4 kg ha^{-1}). Eight treatments consisting of T_1 weedy check, T_2 Hand weeding at 20 and 40 DAS (weed free), T_3 Cardboard mulching, T_4 Paddy straw mulching @5t ha^{-1}, T_5 Farmer's practice, T_6 Wood chips mulching @5tha-1, T_7 Live mulch with a legume (black gram) and T_8 FYM mulching @10tha^{-1} was tested in RBD with three replications. GT 10 variety of sesame was line sown on 16th April 2021. FYM was applied to the field before hand. Mulches were applied onto the field after germination and hand weeding was done accordingly. Weeds were counted and recorded at 25 and 50 DAS from three selected quadrates of 0.5m x 0.5m and were counted and expressed in number of weeds per m^2 using square root transformation ($\sqrt{x+0.5}$) to normalize their distribution. The dry weight and weed control efficiency of the same was recorded. Yields were harvested from the net plot and recorded, and the economics of the treatments were accounted for.

RESULTS AND DISCUSSION

Effects on weeds

Weed flora in the experimental field were recorded on the 25th and 50th days after sowing. In the experiment, 17 weed species were identified, out of which 11 were found broad-leaved weeds, 5 were grasses, and 1 sedge. The predominant weed species in the experimental field were *Elusine indica, Digitaria sanguinalis*, *Oplismenus spp. Amaranthus viridis, Mimosa spinosa, Mimosa diplotricha* and *Cyperus iria.* The total population of all grassy, broadleaved and sedges were found to be highest in T_1 weedy check and among the other treatments T_8 FYM mulching @10tha^{-1} recorded the highest.

Table 1: Weed dynamics of sesame as influenced by different non-chemical weed management

Symbol	Treatments	Weed population ((No.m^{-2})			Dry weight of weeds (gm^{-2})	WCE (%)
		Total Grassy weeds	Total BLW	Total sedges		
T_1	Weedy check	21.37 (457.33)	14.65 (214.67)	5.08 (25.33)	14.54 (210.8)	0.00
T_2	Hand weeding at 20 & 40 DAS.	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	100.00
T_3	Cardboard mulching	11.78 (138.67)	10.14 (104.00)	4.51 (14.67)	6.50 (43.81)	79.90
T_4	Paddy straw mulching @5tha^{-1}	14.64 (214.67)	10.46 (109.33)	4.67 (21.33)	7.34 (53.50)	74.56
T_5	Farmer's practice	16.76 (281.33)	13.31 (180.00)	5.56 (30.67)	7.91 (62.06)	70.55
T_6	Wood chips mulching @5tha^{-1}	12.92 (172.00)	9.57 (93.33)	3.84 (20.00)	6.62 (42.67)	79.34
T_7	Live mulch with legume (black gram)	16.45 (272.00)	11.77 (141.33)	4.04 (16.00)	7.06 (52.91)	75.38
T_8	FYM mulching @10tha^{-1}	19.64 (385.33)	14.02 (196.00)	4.64 (21.33)	10.86 (66.74)	44.24
	S. Em ±	0.80	0.89	0.29	0.52	3.56
	CD (P= 0.05)	2.45	2.69	0.87	1.57	10.82

At all growth stages, T_2 (Hand weeding @20 and 40 DAS) was found to be superior in reducing the weed population in the experimental field as well as in the case of dry weight of weed and highest in weed control efficiency. Among the various non-chemical weed management practices applied, the application of wood chips mulching @5t ha^{-1} (T_6) was found to be superior in weed suppression. This significantly lower weed population in wood chip mulching is due to the weed suppression ability of the applied a particle, which is in conformity with Pakdel *et al.* (2011), who, in an experiment, concluded that the mulches with

smaller particles aid the suppression of weed growth. Zheng *et al.* (2022) also suggested that using wood chips mulch provides insulation and barrier effect to the soil. Cardboard mulching (T_3) was at par with wood chips mulching @5t ha^{-1} (T_6). The weedy check T_1 recorded the highest weed population, dry weight, and lowest weed control efficiency. This may be because, without any external interference, the weeds thrived. The above data is presented in Table 1.

Table 2: Growth attributes of sesame as influenced by different non-chemical weed management practices

Symbol	Treatments	Plant height (cm)	No. of primary branches $plant^{-1}$	No. of branches $plant^{-1}$	LAI (60 DAS)	Days to 50% flowering	Days to maturity
T_1	Weedy check	117.40	1.47	2.33	0.14	44.33	100.00
T_2	Hand weeding at 20 & 40 DAS.	152.53	2.53	3.07	0.38	44.33	102.33
T_3	Cardboard mulching	136.33	2.27	2.93	0.23	45.00	102.67
T_4	Paddy straw mulching @5tha^{-1}	134.80	1.87	2.73	0.22	45.33	100.00
T_5	Farmer's practice	118.00	1.47	2.53	0.14	44.67	102.33
T_6	Wood chips mulching @5tha^{-1}	130.00	2.07	2.73	0.18	45.67	102.33
T_7	Live mulch with legume (black gram)	135.07	1.93	2.93	0.15	45.67	101.33
T_8	FYM mulching @10tha^{-1}	127.00	2.20	2.27	0.17	45.00	102.33
	S. Em ±	6.45	0.25	0.30	0.01	0.41	1.36
	CD (P= 0.05)	19.56	0.75	0.92	0.04	1.24	4.13

Effects on crop

Plant height of sesame was influenced, and significantly taller plants were recorded under various non-chemical weed management methods. As presented in Table 2, the tallest plant height was given by T_2 (Hand weeding at 20 and 40 DAS), this result agrees with Sagarka *et al.* (2013), who reported that significantly the highest plant height was recorded under the weed-free check. The T_1 weedy check (control) showed the lowest plant height in all growth stages, which was evidently because of more crop-weed competition without any applied treatments and this result is in conformity with Chaudhari *et al.* 2023. Among the various non-chemical weed management practices, the highest plant height, no. of primary branches, no of branches, and leaf area index was obtained from FYM mulching (T_8) at 30th DAS and at 60th and 90th DAS cardboard mulching (T_3) obtained the highest plant height, no. of primary branches, no of branches and leaf area index and all treatments were significantly superior to the weedy check. There was no significant variation between the treatments in days to 50% flowering and days to maturity. The growth and yield attributes were reflected in the yield of sesame. Significantly higher seed yield, stover yield, test weight, and harvest index were recorded from T_2 (Hand weeding at 20 and 40 DAS) and were followed by cardboard mulching (T_3) in terms of

Table 3: Yield attributes and yield of sesame as influenced by different non-chemical weed management practices

Symbol	Treatments	No. of capsules $plant^{-1}$	Capsule length (cm)	Seed yield ($kgha^{-1}$)	Stover yield ($kgha^{-1}$)	Test weight (g)	Harvest Index (%)
T_1	Weedy check	49.80	2.63	256.67	1621.57	2.89	19.38
T_2	Hand weeding at 20 & 40 DAS.	78.53	2.89	695.05	2265.77	3.06	23.47
T_3	Cardboard mulching	72.60	2.79	634.58	1819.66	2.88	26.05
T_4	Paddy straw mulching @5tha^{-1}	70.33	2.75	548.17	1903.82	2.90	22.36
T_5	Farmer's practice	63.47	2.65	390.93	1436.98	2.87	21.38
T_6	Wood chips mulching @5tha^{-1}	71.27	2.75	592.62	1535.31	2.97	27.73
T_7	Live mulch with legume (black gram)	67.07	2.74	519.71	1609.13	2.89	24.54
T_8	FYM mulching @10tha^{-1}	62.60	2.65	05.53	1865.68	2.88	24.61
	S. Em ±	2.43	0.07	33.24	99.29	0.04	1.11
	CD (P= 0.05)	7.36	0.22	100.82	301.17	0.13	3.37

seed yield and harvest index, and that of stover yield was associated with T_4 (paddy straw mulching @5tha^{-1}). The lowest was associated with (T_1) weedy check.

Table 4: Economics of cost of cultivation

Symbol	Treatments	General cost (Rs ha^{-1})	Cost due to treatment (Rs ha^{-1})	Total cost (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B: C
T_1	Weedy check	12472	0	12472	21209.81	8738	0.70
T_2	Hand weeding at 20 & 40 DAS.	12472	13440	25912	53185.04	27273	1.05
T_3	Cardboard mulching	12472	8180	20652	48059.91	27408	1.33
T_4	Paddy straw mulching @5tha^{-1}	12472	7680	20152	42179.54	22028	1.09
T_5	Farmer's practice	12472	3360	15832	30239.06	14407	0.91
T_6	Wood chips mulching @5tha^{-1}	12472	9480	21952	44554.01	22602	1.03
T_7	Live mulch with legume (black gram)	12472	5560	18032	39597.72	21566	1.19
T_8	FYM mulching @10tha^{-1}	12472	10180	22652	46118.23	23466	1.04

Economics

Economic feasibility is the ultimate goal of any practice. If the treatments applied do not fetch a good return, however effective it may be, it may not be feasible or acceptable for the farmers (Kumar *et al.,* 2012). T_2 (Hand weeding at 20 and 40 DAS) recorded the highest gross return. However, manual hand weeding was expensive as it was labour-intensive, which influenced the net returns. Cardboard mulching (T_3) recorded the highest net return, and also the highest benefit-cost ratio, which was at par with T_7 (Live mulch with a legume, black gram), suggesting to be the most economical and accessible among all the various non-chemical weed management practices experimented with.

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