Effects of Organic Mulch and Plastic Mulch on Groundnut Yield and Weed Biomass at Nawalpur, Sarlahi

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Abstract: A study was carried out at Oilseed Research Program, Nawalpur, Sarlahi, in 2020 and 2021 to compare the impact of plastic and organic mulch on groundnut yield and weed biomass. The randomized complete block design (RCBD) with three replications was used in this experiment. Seven treatments were as follows: rice husk, rice straw, black polythene sheet, *Lantana camara*, living mulch, sawdust, and control. Result showed that *Lantana camara* mulching produced the lowest biomass for narrow leaf weed (0.062 t/ha) in 2020 and (0.046 t/ha) in 2021, which was followed by the black polythene sheet mulching (0.063 t/ha) in 2020 and (0.046 t/ha) in 2021. However, the plot mulched with rice straw had the lowest biomass of broad leaf weed (0.037 t/ha) in 2020 and (0.014 t/ha) in 2021. Notably, the plot treated with rice husk mulch produced the highest pod yield (2.35 t/ha) in 2020 and (2.07 t/ha) in 2021, with the living mulch treated plot coming in second (2.13 t/ha) in 2020 and (1.84 t/ha) in 2021. In conclusion, the use of organic mulches such as *Lantana camara* and rice straw may be a more effective way to reduce weed intensity while improving groundnut yield compared to plastic mulch.

Keywords: Groundnut, Organic mulching, Plastic mulching, Yield, Nawalpur

Introduction

Groundnut is one of important crop that is ranked 13th among global food crops and fourth among oilseeds (Nigam, 2014). It contains about 48-50% oil content and 26–28% protein (Bhattarai et al., 2021). China and India are the two countries that produce the most groundnuts worldwide; China accounts for over 40% of the production, while India contributes only 15% (Eagritrader, 2014). In 2020-2021, groundnuts productivity was 1.36 t/ha (MOALD, 2023).

In Nepal, 'Badam' is the common name for groundnut. From the Terai to the hilly regions, badam is grown as a major oilseed and cash crop. Groundnut seeds are planted in Nepal in late April or early May and harvested in late August or early October. Weed infestation is one of the numerous contributing factors to the average low productivity of groundnuts (Kalhapure et al., 2013). According to Jat et al. (2011), the intensity of weeds is higher during the Kharif season, which runs from June to November, when a variety of weeds, such as seasonal broad leaf weeds and annual grasses, grow profusely. Digitaria sanguinalis, Cynodon dactylon, Cyperus rotundus are common weeds are found in groundnut (Ghosh et al., 2000). In India, weed infestation decreased groundnut yield by 13-80% (Kalhapure et al., 2013). According to Kalaiselvan et al. (1991), obtaining the highest yield required a weed-free environment for 15 to 40 days following seeding. Mulching is an efficient way to keep weeds out of the soil, retain soil moisture, and keep the soil at a temperature that will increase crop productivity. According to Veselinovic and Kupresanin (1991), organic mulch suppresses annual weeds and has additional benefits when it decomposes and provides organic matter.

Black polythene sheets completely stop weed growth as photosynthesis cannot occur in the absence of sunlight by preventing sunlight from penetrating the soil (Barche et al., 2014). When sawdust is applied as mulch, broadleaf weeds (Cyperus rotundus) are more vulnerable to its allelopathic potential than grassy weeds (Abouziena et al., 2015). The biological activity of *Lantana camara* oil is influenced by its chemical makeup. Other plant species' germination and growth were inhibited by the extracts, essential oil,

leachates, residues, and rhizosphere soil surrounding *Lantana camara* (Mishra, 2015). The mulching affects crops differently; for example, cucumbers treated with black film mulched the highest plant height and number of leaves, and their transparent film mulched the highest number of fruits per plant, which was followed by the highest yield within the first 30 days of harvest (Hallidri, 2000).

This study was conducted with an aim to increase productivity of groundnut and reduce the weed infestation in groundnut cultivated field. The trail comprises of seven different mulching treatments in 2020 and 2021 at the Oilseed Research Program (ORP), Nawalpur, Sarlahi.

Material and Methods

Mulching Materials

Rice straw and rice husk were collected from the nearby field. Black polythene sheet of nine micron was collected from Agrovet shop, while *Lantana camara* was collected from Forest Research and Training Center, Sagarnath, Sarlahi. Live mulch was collected from farmers' field, and sawdust was collected from furniture store in Lalbandi, Sarlahi.

Experimental Setup

The field experiment was carried out at Oilseed Research Program (ORP), Nawalpur, Sarlahi, during the summer months of 2020 and 2021. The ORP is situated at 26.9627° N, 85.5612° E, with an elevation of 106 meters above mean sea level. Using a Randomized Complete Block Design (RCBD), the experiment was set up with seven treatments: such as rice husk, rice straw, black polythene sheet, *Lantana camara*, living mulch, sawdust, and control (no mulch). Table 1 displays the treatments' descriptions. Every plot was ploughed twice, then leveled and hoed. The recommended fertilizer dose of 20:40:20 ($N:P_2O_5:K_2O$) kg/hectare was used in this experiment. Spacing of 30cm x 15cm was used, and groundnuts were sown at five centimeters depth. Weeding and irrigation were carried out on a regular basis.

Table1: Description of the treatments

Treatments	Types of treatments used
T_1	Mulching with rice husk
T_2	Mulching with rice straw
T_3	Mulching with black polythene sheet
T_4	Mulching with *Lantana camara* stubble
T_5	Mulching with living mulch
T_6	Mulching with saw dust
T_7	No mulching

Data Recording and Analysis

During the plant growth period, parameters like plant height and weed infestation were noted. In order to determine the biomass weight, each weed in the plot was removed individually and then divided into broad and narrow leaf weeds. They were harvested by hand when the pods showed signs of browning. The statistical software called Genstat 18th Edition was used for data analysis.

Results and Discussion

Effect of Mulching on Pod Yield

A significantly high pod yield was observed during both years of observation when rice husk and living mulch were used as mulch (Table 2). In the plot without mulching, the yield was noticeably lowest (Table 2). In 2020, the yield of groundnut in polythene sheets was much lower, averaging 22.7 pods per plant and 0.98 tons of pods per hectare. Priyadharshini and Seran (2006) corroborate with our findings, showing that plots treated with paddy husk ash had more pods than other plots. Muthadhi et al. (2007) reported that rice husk contains 0.72–3.84% K_2O. Potassium is involved in the flow of nutrients, water, and carbohydrates through plant tissue. The higher number of pods in groundnuts could be due to the high potassium content in rice husk (Bhattarai et al., 2023). The thickness of the polythene mulch, which prevented groundnut pegging, may be the reason for the lowest number of pods in the black polythene mulched plots.

Our findings also agreed as reported by Ekwu et al. (2017), who discovered that black plastic mulch produced the lowest cucumber yield and rice hull mulched plots produced the highest yield. Tipu et al. (2014) report that the rice husk had the greatest number of fruits recorded, while the control had the lowest number. Furthermore, organic mulch and living mulch outperformed other mulches in sustaining a desirable soil temperature, according to Walsh et al. (1996).Rice husk mulching outperformed plastic and no mulch treatments in terms of tomato yield (Nkansah et al., 2003). According to Jackson (1977), rice husk is composed of 33% cellulose and 7% lignin. While lignin offers structural support and permits long-distance water transportation, cellulose gives the plant its stiffness and strength (Duchesne et al., 1989). Badar and Qureshi (2014) state that composted rice husk mulch has higher total carbohydrate and protein contents, which may raise soil fertility by increasing the soil's organic content.

Table 2: Pod yield of groundnut under different mulching treatments during 2020 and 2021

Treatments	Pod yield (Pods/plant)		Pod Yield (tons/ha)	
	2020	2021	2020	2021
T_1	29.3	29.0	2.35	2.07
T_2	27.0	26.7	1.62	1.62
T_3	22.7	23.0	0.98	0.96
T_4	28.3	27.0	1.65	1.37
T_5	28.3	28.3	2.13	1.84
T_6	27.0	26.0	1.46	1.62
T_7	24.7	23.7	0.90	0.83
Grand Mean	26.8	26.2	1.59	1.47
Min	22.7	23.0	0.90	0.83
Max	29.3	29.0	2.35	2.07
P-value	0.003	0.032	<.001	<.001
LSD 0.05	2.80	3.7	0.23	0.4745
CV, %	5.9	7.9	8.1	17.2

Effect of Mulching on Weed Infestation

The lowest biomass for narrow leaf weed was observed on *Lantana camara* mulching, followed by black polythene sheet mulching (Table 3). However, there was no significant difference in weed biomass between plots with different treatments. In contrast, the rice straw mulched plot had the lowest biomass for broad leaf weed (Table 3).

Effect of Mulching on Plant Height

In 2020, the plant height was higher in a black plastic mulched plot, followed by *Lantana camara* mulched plot (Table 3). In 2021, *Lantana camara* mulched plot produced taller plants with an average plant height of 63.33 cm, while a black polythene mulched plot produced plants with an average plant height of 62.47 cm. Plant height was significantly higher under groundnut mulched with polythene, according to Dutta (2006). *Lantana camara* has a very high protein content of 24.84±0.51% and a high mineral concentration of 1.05±0.03 ppm in potassium (Haruna et al., 2015). The presence of minerals and protein that guarantee a constant

supply of nutrients to plants may account for the taller plants mulched with *Lantana camara*. Lowest plant height was observed in saw dust mulching treatment as shown in Table 3.

Table 3: Effect of mulching treatments on plant height and weed biomass of groundnut

Treatment	Plant Height (cm)		Narrow leaf weed weight (tons/ha)		Broad leaf weed weight (tons/ha)	
	2020	2021	2020	2021	2020	2021
T_1	55.7	57.53	0.070	0.047	0.047	0.025
T_2	55.7	57.47	0.077	0.049	0.037	0.014
T_3	63.0	62.47	0.063	0.046	0.040	0.023
T_4	62.9	63.33	0.062	0.046	0.042	0.021
T_5	56.0	55.53	0.070	0.047	0.038	0.023
T_6	55.6	56.27	0.072	0.053	0.047	0.025
T_7	56.3	56.80	0.082	0.053	0.050	0.019
P-value	ns	ns	ns	ns	ns	Ns
Grand mean	57.9	58.49	0.071	0.049	0.043	0.022
LSD 0.05	-	-	-	-	-	-
CV, %	6.7	12.22	29.42	40.49	21.66	25.88

Conclusions

Mulching with rice husk, black polythene, and *Lantana camara* appears to be more effective for reducing weed biomass compared to other treatments. In treatments with *Lantana camara*, rice husk, and black polythene, there were significantly more pods per plant with higher pod yield; in contrast, yield in black polythene mulch was relatively lower. This might be due to rice husk contains cellulose, lignin, and silica, which all aid in promoting plant growth.

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Authors' Contributions

B. P. Yadav designed research and revised the article for publication. P. Wagle, and A. Chaudhary conducted the trial and P. Wagle, A. Chaudhary, A. Mishra, R. D. Chaudhary, P. Sah and M. K. Sah wrote the final manuscript.

Conflict of Interest

The authors declare no conflicts of interest.

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