RESEARCH ARTICLE

RESPONSE OF PADDY STRAW AND WEED BIOMASS MULCHING ON GROWTH, YIELD AND ECONOMIC PERFORMANCE OF GINGER (*ZINGIBER OFFICINALE*)

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Abstract: Ginger is an important spice crop in the North eastern region of India. It is consumed as a vegetable as well as in dried form as spice. It is also considered as a cash crop for enhancing the livelihood and economic condition of the ginger growers in this region of India. An on farm trial was conducted on ginger using the technology of paddy straw and weeds biomass mulching in Ngangching village of Mon district of Nagaland under rainfed condition during the year 2020. From the trials conducted, it was observed that the growth attributes and yield were increased in the technology plotas compared to the farmers practice of no mulching. The mean B:C ratio from the trial was also 4.2 as compared to farmers practice of 3.5.

Keywords: Crop, Ginger, Growth, Weed, Yield

INTRODUCTION

Ginger is a valuable spice crop grown annually in India. It grows widely under rainfed as well as in irrigated condition. The leading ginger production in India is Kerala, West Bengal, Assam, Meghalaya, Mizoram, Arunachal Pradesh and Sikkim (Rymbai *et al*., 2018). The North eastern region is considered the organic hub of ginger production in India. It is known to have less fibre, higher oil and oleoresin content as compared to other parts of India. The area and production of ginger in North east region are 51.64 thousand ha and 315.15 thousand tons with the average yield of 6.10 t ha^{-1}. In Nagaland, ginger is grown in an area of 4020 ha with the production of 36780 mt.

Mulching is known to be an effective measure for weeds control, reducing soil erosion, increases the soil organic matter, and improves soil physical properties, maintained soil temperature and moisture conservation incrops. Straw mulching also enhanced the soil microbial activity and aeration thereby positively influenced the growth and yield of the crop (Patel *et al*., 2022 and Chandra *et al*., 2001). The biomass produced from weeds content good amount of plant nutrients. This weed biomass is greatly beneficial where there is scarcity of organic manures (Priya *et al*., 2014).

The farmers practiced the method of slash and burn known as shifting cultivation. No organic inputs are added in the soil to improve the soil fertility, instead the land is kept fallow after crop harvest. Thus, the yield of crop is often low.

Therefore, the present investigation was conducted to compare the farming techniques using paddy straw and weed biomass mulching in gingeragainst the farmers practice of zero mulching.

MATERIALS AND METHODS

A total of 6 nos of on farm trials were conducted in 1 ha of land consisting of 18 farmers from Ngangching village of Mon district of Nagaland in theyear 2020. The technology used was paddy straw and weed biomass mulching @ 2t ha^{-1} and Azotobacter & Phosphotika @4 kg each ha^{-1} as rhizome treatment. Ginger variety Nadia was used for the trial. Sowing was done in the mid of April and harvesting was done in the month of December.Parameters recorded before sowing were soil pH, OC,soil moisture content (%), soil available N, P, K (Table 1) and parameters recorded after harvest were plant height, number of rhizome fingers, Pseudo stems per clump, yield, B:C ratio, pH, OC, soil moisture content (%), soil available N, P and K.The soil pH, organic carbon,available soil nitrogen, phosphorus, and potassium were determined using soil pH meter, Rapid titration method outlined and expressed in percentage as described by Jackson (1973), alkaline KMnO4 distillation method (Subbiah and Asija 1956), Bray's No. 1 method (Bray and Kurtz 1945), flame photometer (Jackson 1973). The soil moisture content was determined by Gravimetric method. The soils were dug out with the help of an auger from 5 cm depth in the field. The fresh soil is weighed, and then oven-dried at 105° C for 24 hours. The soil moisture content is then measured using fresh soil samples and oven-dried soil samples by using the formula:

$$\text{Soil moisture content} = \frac{\text{Fresh weight soil (g)} - \text{Dry weight soil (g)}\ 100}{\text{Dry weight soil (g)}}$$

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Table 1. Soil status recorded before sowing

Parameters on assessment	Technology	Farmer's Practice
pH	4.7	4.8
Organic Carbon(%)	0.45	0.47
Soil Moisture Content(%)	20.3	18.5
Available N (kg ha^{-1})	279.56	265.65
AvailableP (kg ha^{-1})	9.68	9.45
AvailableK (kg ha^{-1})	271.10	260.38

RESULTS AND DISCUSSION

Growth parameters

Mulching with paddy straw and weed biomass increased the growth parameters of ginger such as plant height, number of rhizome fingers and pseudo stems per clump as compared to farmers practice of zero mulching (Table 2). The mean plant height from the technology plot was 55.2 cm as compared to 36.1 cm obtained from the farmers plot. The number of rhizome fingers and Pseudo stems per clump recorded from the treated plot were 42.84 and 17.17 as compared to farmers practice such as 33.64 and 11.39. The plant used the nutrients released into the soil due to quick decomposition of mulches which enhanced the plant growth (Montague *et al*., 2004). The increased in the number of rhizome fingers and pseudo stems per clump due to various mulching was also reported by Kumara *et al*. (2019).

Table 2. Effect of paddy straw and weed biomass mulching on growth parameters of ginger

Location	**Plant height (cm)**		**Number of rhizome fingers**		**Pseudo stems per clump**	
	TP	**FP**	**TP**	**FP**	**TP**	**FP**
Trial 1	55.2	38.7	45.25	35.25	18.23	11.16
Trial 2	53.8	35.3	42.48	35.18	15.15	10.25
Trial 3	55.4	33.4	40.14	32.30	18.17	13.27
Trial 4	56.1	35.9	43.84	33.25	17.14	12.20
Trial 5	54.7	36.7	43.80	35.48	16.12	10.18
Trial 6	55.2	37.1	41.52	30.40	18.18	11.25
Mean	55.07	36.1	42.84	33.64	17.17	11.39

*TP – Technology Plot and *FP- Farmers plot

Yield and economics

The mean yield of ginger due to paddy straw and weed biomass mulching was 17.02 t ha^{-1} whereas in the control plot (farmers practice), the mean yield was 12.54 t ha^{-1} as shown in table 3. The B:C ratio was also found to be higher *i.e*. 4.2 against the farmers practice of 3.5. This increased in yield due to mulching might be due to the increased in growth attributes, decreased weeds competition and enhanced soil health (Kumar *et al*., 2018).

Table 3. Effect of paddy straw and weed biomass mulching on yield and economics of ginger

Location	Yield (t ha^{-1})		B:C ratio	
	TP	FP	TP	FP
Trial 1	17.53	14.31	4.2	3.6
Trial 2	17.49	13.10	4.0	3.3
Trial 3	15.74	11.23	4.2	3.5
Trial 4	16.83	11.10	4.4	3.6
Trial 5	16.87	12.90	4.3	3.5
Trial 6	17.67	12.58	4.2	3.6
Mean	17.02	12.54	4.2	3.5

*TP – Technology Plot and *FP- Farmers plot

Soil chemical properties

The soil chemical properties were also improved in the technology plot due to mulching with paddy straw and weed biomass except soil pH as compared to the farmers practice of no mulching. The mean soil pH, OC, soil moisture content, available N, P and K in the technology plot and the farmers plot are shown in table 4. The decrease in the soil pH due to mulching could be due to the liberation of organic acids from the decomposed mulch in the soil (Kumara *et al.*, 2019). Mulching also improved the soil organic carbon due to quick decomposition of organic mulches thereby enhancing organic carbon in the soil (Sun *et al*., 2021 and Thai *et al*., 2022). The soil moisture content in the soil due to mulching was improved because of the reduction of evaporation from the soil surface which thereby decreased soil erosion, balanced soil temperature and reduced irrigation demand by the crop (Qin *et al*. 2016 and Kader *et al*. 2017). The soil fertility status of the soil after harvest in the technology plot was improved due to the decomposition of organic mulch which release nutrients into the soil thereby enhancing nutrient availability over time (Larentzaki *et al*. 2008).

Table 4. Effect of paddy straw and weed biomass mulching on soil chemical properties after harvest of ginger

Location	pH		OC (%)		Soil Moisture Content (%)		N (kg ha^{-1})		P (kg ha^{-1})		K (kg ha^{-1})	
	TP	FP	TP	FP	TP	FP	TP	FP	TP	FP	TP	FP
Trial 1	4.6	4.7	0.58	0.42	23.40	21.45	295.35	271.25	12.10	9.65	289.15	265.87
Trial 2	4.5	4.8	0.65	0.35	23.10	20.90	298.69	265.65	12.42	9.97	294.45	268.98
Trial 3	4.6	4.7	0.63	0.33	22.15	20.40	300.19	270.10	12.89	9.78	299.35	267.12
Trial 4	4.6	4.7	0.62	0.40	22.50	20.25	297.58	276.42	12.63	9.92	287.64	268.69
Trial 5	4.5	4.8	0.62	0.38	22.80	20.55	299.78	269.16	11.78	9.66	298.16	263.88
Trial 6	4.6	4.8	0.59	0.36	22.95	21.60	296.54	277.15	11.98	9.74	285.14	260.97
Mean	4.6	4.8	0.62	0.37	22.82	20.86	298.02	271.62	12.30	9.79	292.32	265.92

*TP – Technology Plot and *FP- Farmers plot

CONCLUSION

The onfarm trials conducted on ginger using the technology of paddy straw and weed biomass mulching in Ngangching village of Mon district of Nagaland under rainfed condition was found to have positive influence in ginger crop. This technology was found to increase the growth, yield, soil chemical properties as well as the benefit: cost ratio as compared to farmers practice of zero mulching in the jhum field. Therefore, from the trials conducted in the jhum field under rainfed condition, it was observed that this technology adoption will greatly enhance the yield, soil health and livelihood of the farmers in the long run.

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