

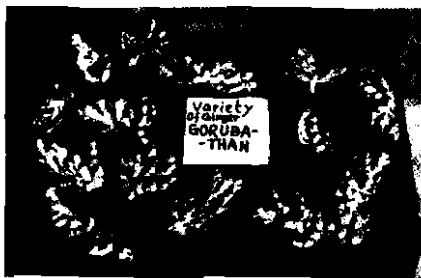


Performance of ginger as intercrop in coconut plantation with organic mulches and the effect of intercropping on the main crop

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It can be concluded that under normal package of practices, planting of ginger with paddy straw mulch, as intercrop in coconut plantation was the best for better growth and higher yield and the companion crop in the coconut garden did not affect the yield of main crop but increased the productivity.



Rhizomes of ginger cv. Gorubathan

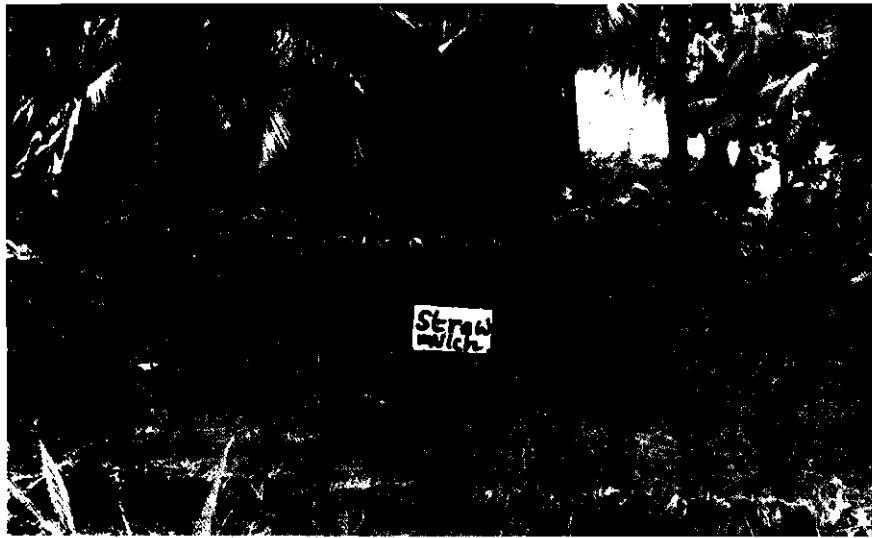
Abstract

An experiment was conducted to study the efficacy of different organic mulching in ginger (*Zingiber officinale* L) var Gorubathan as intercrop in a 21 yrs old coconut (cv.-ECT) garden at H. R. S. Mondouri, BCKV, WB for two years 2001 and 2002 in RBD with three replications. Nine different cheap and easily available mulches and control *ie.* without mulching was taken. Significant difference on growth and yield parameters except clump length were observed. Maximum plant height (116.12cm) was observed under paddy straw followed by water hyacinth (111.66cm). The plants raised with paddy straw mulch recorded maximum tiller number (17.66), maximum leaf number per clump (272.4) with maximum leaf length (23.26 cm) and leaf breadth (2.68 cm). It was observed that highest clump weight (288.33 g) with maximum length (21.53 cm) and breadth (13.60 cm) were obtained from the plants under paddy straw mulch. The highest yield per hectare

(28.70 t /ha) was obtained under paddy straw mulching plants followed by composted coir pith (27.60 t / ha) and water hyacinth (27.40 t / ha) as compared to lowest yield per hectare (15.3 t / ha) with control. The net return/ha from intercrop was highest in case of straw mulch Rs. 132400/- with a maximum B:C (Benefit : Cost) ratio of 1.36. Nut yield during the experimental period increased by 7 (10.61%) and 3 (4.62%), over initial in intercropping and monocropping block respectively. It can be concluded that under normal package of practices, planting of ginger with paddy straw mulch, as intercrop in coconut plantation was the best for better growth and higher yield and the companion crop in the coconut garden did not affect the yield of main crop but increased the productivity.

Introduction

Ginger (*Zingiber officinale* L.) is one of the most important major spices of India. India enjoys the unique position of being the largest producer, consumer and exporter of



Ginger cultivated under straw mulching

ginger in the world. Ginger is widely used in food, beverage, confectionary and medicine. The productivity and quality of this crop need to be increased not only for internal consumption but also for export purpose. Mulching is one of the most important agrotechniques which influence the growth and yield of ginger. Information in respect to mulching for an intercrop like ginger is lacking. In coconut holdings with palms spaced at 7.5 m x 7.5 m, nearly 75 percent of the land resource remained unutilised by the palm. Maximum root activity in the area is upto a radius of 2 m around the base of the palm. Effective utilization of available space, both horizontally and vertically, is the modern concept of cropping system. Multispecies cropping system ensures maximum resource capture and use, leading to higher yield per unit area of soil, water and light. Improvement in the soil properties and biological activities in the root region due to intercropping, results in the modification of soil environment for the benefit of the plant growth (Maheswarappa *et al.*,

1998). A well designed, high density multistoreyed crop model suited to a given agro-climatic situation generates greater biomass output, yields more economic produce, generates steady and higher total income, additional employment opportunities for family labour and meets diversified needs of the farmers, such as food, fruit, vegetables, fuel, etc. (Rethinam, 1990). Since the coconut plantation is ideal for growing spice crops like ginger the present investigation was carried out to find out the efficacy of different organic mulches for higher production of ginger when grown as intercrop with coconut and also to evaluate the effect of intercropping on growth and yield of coconut.

Materials and methods

The experiment was laid out in RBD with three replications at Horticultural Research Station, Mondouri and Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal for two consecutive years 2001 and 2002. Ginger was grown under coconut cv. East Coast Tall

plantation of 20 years old. The variety of ginger was Gorubathan. Treatments comprising of nine different locally available organic mulches viz. banana leaf (*Musa* sp.), coconut leaf (*Cocos nucifera*), coir pith, deodar leaf (*Polyalthia longifolia*), litchi leaf (*Litchi chinensis*), mango leaf (*Mangifera indica*), paddy straw (*Oryza sativa*), teak leaf (*Tectona grandis*), water hyacinth (*Eichornia crassipes*) and control *ie.* without mulching. The raised beds for ginger were prepared 2.0 m away from either side of the coconut palms. Each plot measuring 3.0 m x 1.0 m consisted of twelve rows with four plants per row. Accordingly 48 ginger plants spaced at 25 cm x 25 cm apart were accommodated per plot. Dithane M-45 (0.3 per cent) treated healthy rhizomes (20-25 g) of ginger cv. Garubathan having at least two buds were planted in the last week of April during both years. Fertilizers @ 100:60:100 NPK kg/ha were applied at three splits. Entire phosphorus with FYM @ 20 t/ha were given as basal application. Half of both nitrogen and potassium were top dressed at 45 days after planting (DAP) followed by final dressing with remaining nitrogen and potassium at 90 DAP. Crop was mulched according to treatments immediately after planting. Earthing up and additional mulching was done after each split application of fertilizer. The crop was harvested at 8 months (approx.) after planting. Scheduled agronomic management practices were followed in coconut with fertilizer dose of NPK @ 500:250:750 g/palm/yr. Five randomly selected plants from sampling rows were tagged for recording the data on both growth and yield attributes



and were analysed following the standard statistical procedure. The growth and yield parameter of coconut from monocrop and intercrop block were taken on average basis. Number of leaves produced per palm was counted twice in a year at six months interval, through addition of scar marks and number of leaves in the palm. Number of bunches produced per palm were counted twice in a year. Number of nuts per bunch were counted during harvesting and total nuts produced in a year was worked out. Randomly selected five nuts at harvest were weighed.

Results and Discussion

Growth and yield parameters of ginger

Character wise analysis of variance results have been presented in Table 1 and 2. Significant differences among different treatments are recorded among the growth and yield parameters of ginger. Maximum plant height (116.12cm) with maximum tiller



Ginger 215 days after planting under paddy straw mulching

(17.66) and leaf number per clump (272.4) were observed under paddy straw mulching as compared to minimum height (82.34 cm) with minimum tiller number (9.33) and minimum leaf number per clump (163.4) with control *ie* without mulching. Different mulches had significant influence on leaf length however, in case of leaf breadth effect was non significant. Maximum leaf length (23.26 cm)

was observed under paddy straw followed by water hyacinth (22.33 cm) and composted coir pith (21.76 cm) as compared to minimum leaf length (16.5 cm) with control. Maximum leaf breadth (2.68 cm) was observed under paddy straw mulching. The results are in good agreement with Korla *et al* 1990 and Mohanty *et al* 1991.

Weight of clump is an important yield contributing trait which directly influence the yield. It was observed that highest clump weight (288.33 g) with maximum length (21.53 cm) and breadth (13.60 cm) were obtained from the plants under paddy straw mulch. The lowest clump weight (184.95 g) with minimum length (15.16 cm) and breadth (8.56 cm) were obtained from control. The highest yield per plot (13.3 kg/3m²) was obtained under paddy straw mulching plants as compared to lowest yield (7.1kg/ 3 m²) with control. Accordingly highest yield per hectare(28.70 t /ha) was obtained under paddy straw mulching plants followed by composted coir pith (27.60 t / ha)

Table 1. Effect of different mulch materials on growth parameters of ginger

Treatment	Plant height (cm)	Number of tillers/ clump	Number of leaves/ clump	Leaf length (cm)	Leaf breadth (cm)
T ₁ (banana leaf)	97.69	10.66	200.4	19.12	2.12
T ₂ (coconut leaf)	104.23	14.33	250.2	20.81	2.23
T ₃ (CCP)	109.51	13.66	260.6	21.76	2.35
T ₄ (deodar leaf)	101.33	12.66	230.8	19.83	2.18
T ₅ (fitchi leaf)	110.56	13.66	240.2	20.76	2.29
T ₆ (mango leaf)	102.43	13.33	235.4	19.63	2.28
T ₇ (paddy straw)	116.12	17.66	272.4	23.26	2.68
T ₈ (teak leaf)	103.84	11.66	242.8	20.83	2.29
T ₉ (waterhyacinth)	111.66	15.33	265.6	22.33	2.46
T ₁₀ (control)	82.34	9.33	163.4	16.5	1.97
SEm ±	1.411	1.642	3.18	0.281	0.611
C.D. at 5 %	3.033	3.546	6.73	0.613	NS

Table 2. Effect of different mulch materials on yield parameters of ginger

Treatment	Weight of clump (g)	Length of clump (cm)	Breadth of clump (cm)	Yield per plot (kg/3 m ²)	Projected yield (t/ha)
T ₁ (banana leaf)	203.23	17.87	11.26	10.63	22.96
T ₂ (coconut leaf)	232.61	18.60	11.70	11.42	24.63
T ₃ (CCP)	268.46	21.03	12.63	12.84	27.63
T ₄ (deodar leaf)	217.66	18.10	11.40	10.82	23.26
T ₅ (litchi leaf)	246.57	19.80	12.26	11.83	25.43
T ₆ (mango leaf)	216.35	18.73	11.96	11.63	25.06
T ₇ (paddy straw)	288.33	21.53	13.60	13.32	28.72
T ₈ (teak leaf)	214.75	18.30	11.50	10.03	23.83
T ₉ (water hyacinth)	243.84	20.10	12.63	12.74	27.41
T ₁₀ (control)	184.95	15.16	8.56	7.23	15.32
SEM ±	12.951	2.871	0.821	0.921	1.971
C.D. at 5%	27.092	NS	1.763	1.982	4.254

and water hyacinth (27.40 t / ha) as compared to lowest yield per hectare (15.3 t / ha) with control.

Total rhizome weight is the reflection of total photosynthesis that occurred in the plant. Naturally a plant with good vegetative growth is indicative of its efficient photosynthesis and simultaneous partitioning of photosynthates towards sinks. It was interesting to note that each mulch treatment performed better over control of which the performance of paddy straw mulch was superior over others. Yield increase of 200 per cent was recorded by mulching with 20 t of green leaves per hectare compared to non mulching (Kanan & Nair, 1965). Mohanty *et al* 1977 recorded 31.1t/ha rhizome yield of ginger with banana leaf mulch. Roy and Wammanan 1988 also recorded 24.1t/ha rhizome yield of ginger with green forest leaf mulch.

The economics of mulching has been presented in Table 3. Economic assessment (mean of 2 years) considering all inputs revealed that maximum cost of

cultivation amounts to Rs. 97200/- for straw mulch. The gross return realised was as high as Rs. 229600/- from straw mulch where as it was only about Rs. 35100/- for control *ie* without mulching. The net return/ha from intercrop was highest in case of straw mulch Rs. 132400/- with a maximum B: C ratio of 1.36. These results are in good agreement with Sairam *et al.* (1997). Intercropping will not in any way reduce the returns from the coconut, rather it improves and adds to the total return per unit area.

Table 3. Economics of ginger cultivation with different mulch materials

Treatment	Cost of cultivation (Rs. /ha)	Gross return (Rs. /ha)	Net return (Rs. /ha)	Beuefit : Cost
T ₁ (banana leaf)	91500	183200	91700	1.01
T ₂ (coconut leaf)	91200	196800	105600	1.16
T ₃ (CCP)	94600	220000	125400	1.33
T ₄ (deodar leaf)	91500	185600	94100	1.02
T ₅ (litchi leaf)	92000	203200	111200	1.21
T ₆ (mango leaf)	92000	200480	108480	1.18
T ₇ (paddy straw)	97200	229600	132400	1.36
T ₈ (teak leaf)	91200	190400	99200	1.08
T ₉ (water hyacinth)	94600	219000	124400	1.31
T ₁₀ (control)	88500	122600	35100	0.40

ii) Effect of intercropping on production of leaf, bunch, nut yield and nut weight of coconut

Variations with respect to annual leaf and bunch production were recorded. The plants under intercropping produced higher number of leaves (11.7) and bunch (10.6) as compared to lower number of leaves (10.8) and bunch (9.8) in monocropping. Ravindran and Nair (1999) reported that mono cropping of coconut recorded lower plant height and stem girth as compared to the plants in coconut + intercrop. Nut yield during the experimental period increased by 7 (10.61 per cent) and 3 (4.62 per cent), over initial in intercropping and monocropping block respectively (Table 4). Nut yield at the end of investigation period was 73 and 68 as compared to initial yield of 67 and 65 nuts per palm per year in intercropping and monocropping block respectively, suggesting that companion crops in the coconut garden did not affect the yield of base crop but increased the productivity as a whole as recorded earlier (Chowdhury and Deka, 1997). Similarly, it was reported by

Table 4. Effect of intercropping on leaf production and yield of coconut

Period	No. of leaves/palm		No. of bunches/palm		Nut yield/palm/year		Weight of nut (g)	
	Coconut monocrop	Coconut + Intercrop	Coconut monocrop	Coconut + Intercrop	Coconut monocrop	Coconut + Intercrop	Coconut monocrop	Coconut + Intercrop
Pre experiment	10.5	10.8	9.6	10.2	65	67	980	985
Post experiment	10.8	11.7	9.8	10.6	68	73	989	1045
Total Increase	0.3	0.9	0.2	0.4	3	7	9	60
Percentage Increase	2.86	8.33	2.08	3.92	4.62	10.61	0.92	6.09

Singh *et al.* (2002) that due to intercropping the nut yield was 53.43 nuts/palm/year as compared to 41.8 nuts/palm/year in monocrop block in a period of two years showing a clear impact of intercropping with better management in increasing the productivity of the system as a whole. The present results are also in good agreement with the earlier observations of Maheswarappa *et al.* (1998), Marimuthu *et al.* (2001) and Nath (2002). Variation in respect of nut weight was also recorded. The higher nut weight (1045 g) was observed in intercropping as compared to lower nut weight (989g) in plants under monocropping at the end of experiment.

Conclusion

The vegetative vigour and yield contributing characters of ginger differed with different mulching which was reflected on the rhizome yield. Increased yield under mulched treatments may be due to higher magnitude of yield attributes affected by higher soil temperature, more conservation of soil moisture, less weed population and activity of micro organism in soil resulting in more availability of nutrients and ultimately more photosynthates. Nutrient availability through decomposition varied widely among different mulches. Better performance of paddy straw mulch,

water hyacinth and composted coir pith (CCP) may be due to their quicker decomposition and supply of nutrients. It can be concluded that in normal package of practices, planting of ginger with paddy straw mulch, as intercrop in coconut plantation was the best for better growth and higher yield and the companion crop in the coconut garden did not affect the yield of main crop but increased the productivity.

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