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IN SITU GREEN MANURE PRODUCTION AS MULCH MATERIAL FOR GINGER

Ginger is an important export oriented spice crop of India. Kerala leads in ginger production and export and enjoys a unique position as the major supplier of export quality Cochin and Calicut ginger. The cultivation of ginger is highly risky due to the occurrence of diseases, high cost of production and uncertain prices. In Kerala, ginger is grown purely as a rainfcd crop and this necessitates heavy mulching to conserve soil moisture, control weeds and for enriching the soil through addition of organic matter. The recommended mulching of thrice in a year requires 30 tonnes of green leaves (KAU, 1993). A self sustainable system making full use of land and space to provide maximum biomass is gaining significance in ginger cultivation due to the high requirement of organic materials for mulching and its acute scarcity resulting from denudation of forests. The comparative efficacy of leguminous green manure crops grown along with ginger on biomass production and its influence on growth and yield of ginger was evaluated and the results are presented in this paper.

The experiment was laid out in a randomised block design with 12 treatments (Table 1) and three replications during May 1997. The treatments included five types of green manure crops sown at various stages of ginger crop. Ginger was planted on raised beds of 2 m^2 with inter-channels of 50 cm. Seed bits weighing 20 g were planted at a spacing of 25 x 25 cm. The seeds of green manure crops were sown in the inter-channels @ 15 g, 20 g and 40 g for *Sesbania* spp., sunhemp and fodder cowpea, respectively. Cowpea seeds were sown in treatment No. 11 on the bed at the centre of four ginger plants. The observations on biometric characters of ginger were recorded four months after planting, whereas weight of weeds and yield of biomass from green manure crops were recorded at two and four months after planting, before the second and third mulching. The yield of rhizome was recorded nine months after planting when the above ground parts withered fully.

The data on yield of biomass from the green manure crops, weeds and ginger rhizomes are presented in Table 1.

The biometric characters were not significantly influenced by the treatments suggesting that growing green manure crops in the interspaces did not affect the growth of ginger adversely. However, growing *Sesbania rostrata* resulted in the maximum plant height (57.10 cm) whereas number of tillers (3.76) and number of leaves (24.58) were maximum in plots with daincha in the inter-channel. The ginger plants were lanky in growth with low number of leaves when cowpea was grown on the beds.

The beds and inter-channels were weeded two months and four months after planting and the weight of weeds was recorded. The control plots with no green manure crops recorded maximum fresh weight of weeds at two months and four months after planting indicating that growing of green manure crops reduced the weed flora significantly. At two months after planting, the minium weed growth (0.96 t ha^{-1}) was recorded by fodder cowpea sown in the inter-channel followed by cowpea sown on the beds (1.14 t ha^{-1}) which were on par. Sowing green manure seeds for a second time resulted in a substantial reduction in weed flora at four months after planting. Fodder cowpea showed its superiority in suppressing the weeds, recording the minimum weight of weeds (1.85 t ha^{-1}) at four months after planting also.

The green manure crops showed significant difference with respect to biomass production. Fodder cowpea showed the highest potential for green manure production followed by daincha. This is in conformity with the reports of Valsala *et al.* (1990b) and Ipe (1991) that growing of daincha and cowpea along with ginger for green manure production as mulch material was economically feasible. *Sesbania rostrata*, a species characterised by nodules on the stem, did not differ significantly from *Sesbania acculeata* with regard to biomass production. *Sesbania speciosa* requires a long

Table 1. Influence of green manure crops on yield of ginger, weed growth and biomass production

No.	Treatments		Weight of weeds, t ha^{-1} 2 MAP	4 MAP	Yield of green, t ha^{-1}	Yield of rhizome, t ha^{-1}
1	Fodder cowpea	Seeds sown simultaneously with the planting of ginger and biomass utilized for 2nd mulching	1.71	5.94	26.70	13.61
2	*Sesbania rostrata*		2.31	5.62	14.23	13.99
3	*Sesbania acculeata* (Daincha)		1.88	2.49	18.23	22.60
4	*Sesbania speciosa*		3.56	2.24	4.40	17.19
5	*Crotalaria juncea* (Sunhemp)		2.49	2.24	3.43	11.14
6	Fodder cowpea	Seeds sown as above + seeds sown again during the 2nd month of planting ginger and biomass utilized for the 3rd mulching	0.96	1.85	24.70	21.87
7	*Sesbania rostrata*		1.42	2.24	10.87	14.46
8	*Sesbania acculeata*		4.09	3.27	12.13	20.03
9	*Sesbania speciosa*		3.20	2.24	5.00	20.15
10	*Crotalaria juncea*		3.45	2.42	5.17	21.27
11	Fodder cowpea sown on the beds		1.14	4.73	20.87	17.06
12	Control		4.80	6.40	-	19.50
	CD (0.05)		1.74	3.09	9.67	NS
	CD (0.01)		2.34	4.19	13.14	NS

MAP = Months after planting

crop duration and did not flower within two months after sowing. For this reason it is unsuitable for growing along with ginger and for utilizing the biomass for second mulching of ginger. In contrast with the report of Valsala *et al.* (1990a) sunhemp was found to be least preferable among the green manure crops with regard to green manure production. This can be attributed to the fact that sunhemp is highly sensitive to high soil moisture and for i s bes performance i should be sown and cs ablishcd before he heavy rains. Growing green manure crops additionally for a second time did not favour increased biomass production and a reduction was observed when the mean for two sowing was compared (13.40 t ha^{-1} and 11.57 t ha^{-1} for 1st and 1st + 2nd sowing respectively). The yield of ginger was not significantly influenced by the green manure crops. However, growing of daincha resulted in the highest yield of rhizome (22.60 t ha^{-1}) which may be due to the enhancement of nitrogen and phosphorus status of the soil consequent to growing of daincha as observed by Singh (1974). Fodder cowpea sown twice had also produced substantially high yield (21.87 t ha^{-1}).

Based on the foregoing results it is concluded that fodder cowpea and daincha are suitable green manure crops for a self sustainable system to provide mulch material in ginger cultivation. Fodder cowpea and daincha could supplement 89% and 61% respectively, of the total mulch requirement in the first sowing itself. Fodder cowpea alone was found suitable for second sowing also, to provide material for third mulching.

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