Effect of different mulching materials and weed control measures on growth of coconut seedlings under irrigated condition in Assam

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Successful establishment of coconut garden depends on early growth of seedlings. The vigorous growth of coconut seedlings could be achieved significantly higher by using black polythene mulch or white polythene mulch or organic mulch around the coconut seedlings.

Abstract

An experiment was conducted during 2004-2005 to study the effect of different mulching materials and weed control measures on conservation of soil moisture, weed growth, microbial population and growth parameters of coconut seedlings planted in the main field at CPCRI, RC, Kahikuchi, Assam. The soil moisture content was higher in black polythene mulch followed by white polythene mulch and organic mulch. The growth parameters such as plant height, girth and number of leaves 12 months after treatment imposition were significantly higher in black polythene mulch followed by white polythene mulch and organic mulch. Polythene mulches, organic mulch and herbicide application effectively controlled the weeds around the seedling basin. The highest microbial population was observed under organic mulch.

India occupies third position in area under and production of coconut with 1.93 million hectares producing 12832.9 millions nuts per annum with a productivity of 6632 nuts per ha (2004-05). It is primarily a small land holders' crop numbering about 5 millions holdings distributed in 18 states and three union territories. Although coconut is considered as a non traditional crop in Assam it has been growing in the region from time immemorial. In Assam it is cultivated in an area of 0.21 lakh ha with a production of 163.6 million nuts and productivity of 7754 nuts per hectare. In Assam the coconut cultivation is mainly confined to the central (Marigaon and Nagaon districts) and lower parts (Kamrup, Nalbari, and Barpeta districts) of the state. In recent years the area is being extended to other parts of the State also. As such, in Assam there is no exclusive coconut farmer but still farmers are growing coconut palms in their homestead garden commonly called as 'Bari System of Cropping' under rainfed condition. In such a system, different crop combinations like coconut,

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arecanut, bamboo, banana, fruit trees, timber trees, tuber crops and spices are being grown in unscientific way. In most of the areas of this region, it is also observed that almost every household is having two to five coconut palms in their homestead garden or compound irrespective of social status.

Under Assam condition, heavy rainfall during monsoon period results in luxuriant growth of weeds which hampers the growth and development of coconut seedlings and during summer months crop suffers due to moisture stress. The importance of mulching and weed control has been well recognized in the field of agriculture and farmers have been traditionally practising mulching for their crops using locally available materials like dry leaves etc. In recent years use of polythylene film mulch for soil moisture conservation and weed control is in practice and proved to be effective in many crops (Reddy and Khan, 1998, Shirgure *et al.*, 2003, Nath and Sharma, 1993). Effect of mulching materials and weed control measures on growth and development of coconut seedlings has not been studied under Assam condition and hence an experiment was conducted with an objective to study the impact of mulching materials and weed control measures in controlling weed, soil moisture conservation and growth of coconut seedlings.

Materials and Methods

An experiment was carried out during 2004-05 at Central Plantation Crops Research Institute, Research Centre, Kahikuchi, Assam, which is situated at 20° 18' N latitude and 91° 71' E longitude with mean altitude of 50 m from MSL. The average annual rainfall in the region ranges between 2500 and 3000 mm and most of the rainfall occurs during the months of June to August/September while the period between October to May experience dry spell. The soil of the experimental site was texturally classified as clay loam. The coconut seedlings were spaced at 7.5m x 7.5 m and planted on mounds during 2002 and managed with recommended package of practices, and irrigation was provided during non-rainy season through hose once in 12-15 days @ 100-150 litres/seedling.

The various treatments were :

T1 = White polythylene mulch of thickness of 200 gauge

T2 = Black polyethylene mulch of thickness 200 gauge

T3 = Organic mulch of arecanut leaves @ 20 kg/palm

T4 = Herbicide (Glyphosate) application @ 5 ml per litre

T5 = Hand weeding followed by forking (60 days interval)

T6 = No mulch/No weed control (Absolute control)

There were six seedlings per treatment in a Randomized Block Design with four replications. The different treatments were imposed during July, 2004. The black and white polythene mulch of 200 gauge was spread at the base of seedlings covering 2 m radius, organic mulch of arecanut leaves @ 20 kg per basin were used to cover the basin area. Herbicide round up (Glyphosate) @ 5 ml per litre of water was applied in basin area of 2 m radius during July. Hand weeding followed by forking in basin area was carried out once in 2 months during the experimentation.

The initial growth parameters of coconut seedlings like plant height, girth and number of leaves were recorded during July, 2004. Further the increase in vegetative growth parameters was recorded at the sixth month after treatment imposition (January, 2005) and one year after imposition of the treatment (July, 2005). The soil moisture content at 0-30cm depth under different treatments was recorded gravimetrically in the seedling basin at monthly interval and expressed in percentage. The weeds were collected from the basin of the seedlings at 3,9 and 12 months after treatment imposition and dry weight were recorded. The data on weed dry weight was transformed into $\sqrt{x+1}$, and the analysis and interpretation were carried out. Soil samples were taken at 90 days after treatment imposition at 0-30 cm depth for soil microbial enumeration. The microbial population viz., fungi, bacteria and actinomycetes under different treatments was enumerated by adopting standard techniques.

Results and Discussion

Coconut growth parameters

Growth of coconut seedlings in terms of plant height, girth at base and number of leaves differed significantly among the treatments (Table 1). The highest plant height, girth and number of leaves were recorded in black polythene mulch, followed by white polythene mulch. Application of organic mulch and hand weeding also resulted in better growth of seedlings compared to absolute control. Application of glyphosate herbicide did not show any phytotoxic symptom in coconut seedlings, and growth was significantly higher compared to absolute control but could not

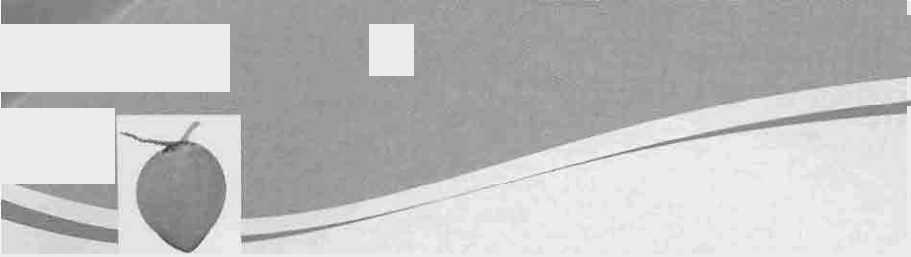

Table 1. Growth parameters of coconut seedlings as influenced by different mulching and weed control measures

Treatments	Plant height (m)			Girth at base (cm)			Number of leaves/seedling		
	Initial (July 2004)	Jan. 2005	July 2005	Initial (July 2004)	Jan. 2005	July 2005	Initial (July 2004)	Jan. 2005	July 2005
T1	1.70	2.30	3.07	20.6	38.7	61.0	7.0	10.0	12.0
T2	1.69	2.40	3.20	21.0	40.4	63.4	6.8	10.2	12.2
T3	1.73	2.23	3.10	21.2	34.9	62.7	7.0	9.9	11.2
T4	1.65	2.19	3.08	20.8	32.0	53.3	6.9	10.0	11.2
T5	1.70	2.19	2.87	21.5	34.7	59.7	7.0	9.9	11.0
T6	1.76	1.95	2.52	21.2	29.2	45.0	7.1	8.7	10.2
CD (P=0.05)	NS	0.127	0.24	NS	2.12	2.22	NS	0.297	0.75

produce significantly vigorous growth compared to mulch treatments, which might be due to the more weed growth during later part of the year. The better growth of seedlings under above treatments was probably due to increase in availability of soil moisture and nutrients and lower weed population. Increase in growth characters of Nagpur mandarin and sapota has been reported by Shirgure *et al.* (2003) and Reddy and Khan (1998) respectively due to application of polyethlene mulches. The seedlings growth was significantly affected and had stunted growth with less vigour under absolute control, which might be due to competition by weeds for water and nutrients and loss of soil moisture through evaporation.

Moisture status

Moisture content at the root zone of the seedlings was found to be signifiantly influenced by the treatments (Table 2). The moisture content under black polythene mulch treatment was higher which was followed by white polythene mulch and organic mulch compared to herbicide treatment, hand weeding and absolute control. The higher soil moisture content under the mulches might be due to reduction in soil surface evaporation and weed growth. The results are in conformity with the findings of Ghosh (1985) in sweet lime, Reddy and Khan (1998) in sapota and Shirgure *et al* (2003) in Nagpur mandarin. The organic mulch with arecanut dry leaves also could conserve soil moisture to a greater extent. Mulching with green leaves and coconut leaves in the coconut basin conserved soil moisture efficiently under sandy loam, laterite soil and littoral sandy soil as reported by many workers (Vardan *et al.*, 1990, Joseph *et al.*, 1994 and Maheswarappa *et al.*, 1998). The moisture content under absolute control was significantly lower due to higher evaporation and transpiration by weeds.

Table 2. Soil moisture content (%) at the root zone (0-30 cm depth) of seedlings as influenced by different treatments

Treatments	30 DAT	60 DAT	90 DAT	120 DAT
T1	25.5	25.20	26.4	24.8
T2	26.12	25.31	26.5	24.9
T3	24.87	24.12	25.1	24.1
T4	22.42	23.1	23.5	22.5
T5	22.0	23.21	23.5	22.1
T6	20.75	21.36	22.2	21.0
CD (P=0.05)	0.54	0.34	0.75	0.44

DAT - Days after treatment imposition

Weed Control

The weeds found around the seedling basin were *Cyperus rotundus, Cynodon dactylon, Bohreria hispida and Azeratum conyzoids.* Significant reduction in weed population was observed with mulching and use of herbicides (Table 3). Under white and black polytheylene mulch treatments, there was 100 per cent control of weed growth only. The weed growth under organic mulch treatment and herbicide treatment was also lower compared to control. The per cent reduction in weed growth under black polyethlene mulch was 98.9 per cent followed by white polyethylene mulch (98.3 per cent), organic mulch (90.3 per cent) and herbicide treatment (86.5 per cent) compared to unweeded control. Further the growth of weeds were more during later part of the year under herbicide treatment. Shirgure *et al.*, (2003) also have reported significant reduction in weed growth under white polyethylene mulch followed by organic mulch in Nagpur mandarin.

Microbial population

The microbial population (fungi, bacteria and actionmycetes) around the seedling basin was found to vary with different treatments (Table 4). The fungi and bacterial population were found to be highest in organic mulch treatment (T3), which might be due to the fact that, the organic mulches reduce the loss of soil moisture and create good microclimate in soil for the proper growth of plant roots and soil flora and fauna. The microbial population

Table 3. Dry weight of weeds as influenced by different treatments

Treatments	Dry weight of weeds (g/seedling basin)		
	3 MAT	9 MAT	12 MAT
T1	1 (0)	7.3 (52.5)	8.7 (75)
T2	1 (0)	6.09 (36.25)	7.01 (48.25)
T3	8.59 (73)	11.63 (134.5)	21.16 (447.5)
	10.99 (120)	20.21 (407.75)	24.95 (622.5)
	11.56 (133)	12.10 (445.75)	18.81 (353.5)
T6	42.72 (1826.2)	63.52 (4035.0)	67.92 (4613.2)
CD (P=0.05)	0.92	0.75	0.76

MAT - Months after treatment imposition
Figures within parentheses are original value

Table 4. Microbial population as influenced by different treatment at 90 days after treatment imposition

Treatments	Micro population (cfu/g of soil)		
	Fungi (10^4)	Bacteria (10^5)	Actinomycetes (10^5)
T1	4.67	31.03	14.02
T2	11.33	18.33	10.33
T3	37.20	69.54	15.00
T4	27.32	42.65	8.87
T5	33.83	66.57	6.17
T6	33.83	64.33	9.53

was lowest in white, black polyethylene mulches and herbicide treatments which might be due to creation of high soil temperature which hampers the microbial population under polythene mulches and the effect of herbicide. The actinomycetes population did not vary much among the treatments.

Conclusions

Successful establishment of coconut garden depends on early growth of seedlings and from the above study it can be concluded that the vigorous growth of coconut seedlings could be achieved significantly higher by using black polythene mulch or white polythene mulch or organic mulch around the coconut seedlings depending upon the availability. The soil moisture conservation was higher under black polythene mulch followed by white polythene mulch and organic mulch. Polythene mulches, organic mulch and herbicide application effectively controlled the weeds around the seedling basin. The highest microbial population was observed under organic mulch application.

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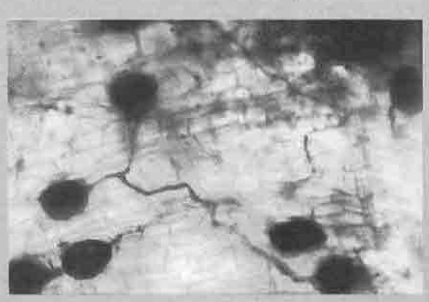
Effect of coconut leachates on mycorhizal association

The impact of coconut leachates (root and leaf) was studied on the percentage of AM association in the roots of vanilla and clove plants, which is an important indicator of the involvement of agriculturally important microorganisms in the overall effect of allelochemicals



on the growth of plants. In non-sterile bulk soil, the addition of the coconut leachates significantly increased the AM association with roots of both clove and vanilla whereas in sterilized bulk soil, there was drastic suppression of AM association

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