

Effect of leaf litter mulch on the sprouting and early growth in tuber crops

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Abstract

The effect of leaf litter mulches on the sprouting and early growth in greater yam and tannia in terms of their alleloathic influences were evaluated at Farming System Research Station, Sadanandapuram, Kerala Agricultural University during 2014-'15. Litter of eight selected tree species were used as mulch materials for the minicorms planted in soil medium and it was found that the effects were significant on sprouting and seedling growth and varied with the tuber crop tried. In greater yam, jack and Ailanthus litter were found to have significant stimulatory effects on early growth, while in tannia, rubber and cashew litter mulch were found best as mulch materials. Mango litter proved inhibitory in both the crops tested restricting its use as mulch materials in tuber cultivation.

Key words: Allelopathy, litter mulch, inhibitory, stimulatory, tuber

Introduction

Dormancy of corms and cormels causing delay in sprouting in tubers are well documented (Craufurd *et al.*, 2001). Hence the agro techniques of cultivation include mulching of tubers planted during May-June so as to induce germination conserving soil moisture and regulating soil temperature. Crop residues and tree litter are the most commonly used mulch materials in tuber cultivation. However, the phenomenon of allelopathy reported with leaf litters (Bhatt and Todaria, 1990; Thakur, 2014) is expected to have an influence on the sprouting and early growth of the corms and cormels. In addition tubers when grown as intercrops in tree-crop systems are bound to be influenced by the litter that accumulates on the soil surface. The accumulation of such litter on the soil under agroforestry system of farming does not only mean a nutrient enrichment, but can also have negative effects on the agricultural crops due to the release of the toxic substances (Ahlgren and Ahlgren, 1981). It is in this background that an experiment was attempted to study the allelopathic influence of tree species litter on the sprouting and early growth of greater yam (*Dioscorea alata*) and tannia (*Xanthosoma sagittifolium*), the commonly grown tuber crops grown as intercrops in agroforestry systems.

Materials and Methods

The multipurpose agroforestry tree species

selected for the experiment conducted at Farming System Research Station, Sadanandapuram, Kerala Agricultural University during 2014-'15 included rubber (*Hevea brasiliensis*), cashew (*Anacardium occidentale*), tamarind (*Tamarindus indicus*), Ailanthus (*Ailanthus triphysa*), nutmeg (*Myristica fragrans*), jack (*Artocarpus heterophyllus*), wild jack (*Artocarpus hirsuta*) and mango (*Mangifera indica*). Allelopathic influences of litter as mulch materials were evaluated in the study using twenty five grams of the leaf litter as mulch materials in each of the 25 g sized minicorms of greater yam and tannia planted in grow bags (40cm x 24cm x 24cm) filled with soil medium compared to the control with no mulch. Irrigation was given as and when rains failed and observations on sprouting percentage, root, shoot length and number of leaves were taken until two months of growth.

Inhibitory / stimulatory effects on crops were expressed in percentage (%) of control and were calculated as T/C, where T, is the "treatment" value and C is the "control" value. The effect is stimulatory when the result is greater than 100%, and inhibitory when the result was less than 100%.

Results and Discussion

The data on the allelopathic effects recorded in the study are presented in Tables 1 and 2.

Table 1. Effect of litter mulch on sprouting and early growth in greater yam

Treatments	Sprouting (%)	Allelopathic effect (%)	Shoot length (cm)	Allelopathic effect (%)	Root length (cm)	Allelopathic effect (%)	Leaf number	Allelopathic effect (%)
Rubber	66.34	76.76	100.67	109.42	36.67	97.35	13.67	110.87
Cashew	86.42	100.00	116.33	126.45	39.67	105.31	40.00	324.41
Tamarind	65.14	75.38	91.67	99.64	41.33	109.72	13.33	108.11
Ailanthus	93.08	107.71	131.33	142.75	49.67	131.86	18.00	145.99
Jack	73.02	84.49	203.00	220.65	63.00	167.24	26.67	216.30
Mango	80.00	92.57	87.00	94.57	26.33	69.90	13.67	110.87
Nutmeg	73.02	84.49	94.33	102.53	33.33	88.48	12.67	102.76
Wild jack	52.88	61.19	102.67	111.60	45.33	120.33	19.00	154.10
Control	86.42	100.00	92.00	100.00	37.67	100.00	12.33	100.00
CD	1.34	-	45.8	-	17.83	-	ns	-

Table 2 Effect of litter mulch on sprouting and early growth in tannia

Treatments	Germination (%)	Allelopathic effect (%)	Shoot length (cm)	Allelopathic effect (%)	Root length (cm)	Allelopathic effect (%)	Leaf number	Allelopathic effect (%)
Rubber	93.08	107.71	32.70	135.29	35.67	93.87	4.93	123.56
Cashew	86.42	100.00	27.00	111.71	34.67	91.24	4.31	108.02
Tamarind	73.02	84.49	27.33	113.07	25.33	66.66	4.31	108.02
Ailanthus	46.21	53.47	3.00	12.41	2.33	6.13	1.58	39.60
Jack	73.02	84.49	27.23	112.66	32.33	85.08	5.31	133.08
Mango	58.86	68.11	5.00	20.69	3.67	9.66	1.58	39.60
Nutmeg	46.21	53.47	5.33	22.05	3.67	9.66	1.59	39.85
Wild jack	86.42	100.00	21.33	88.25	26.40	69.47	3.63	90.98
Control	86.42	100.00	24.17	100.00	38.00	100.00	3.99	100.00
CD	1.34	-	7.90	-	8.74	-	1.91	-

Greater yam : Litter mulch had significant effects on the sprouting and root and shoot length of greater yam nevertheless, did not reflect any significant variation in leaf number (Table 1). The inhibitory effects of seven litters were found to be more pronounced on sprouting, with Ailanthus mulch alone recording stimulatory effect.

Highest significant inhibitory effect on sprouting was recorded with wild jack mulch followed by tamarind. Cashew litter recorded the same percentage of sprouting as that in control.

Variations in root and shoot length were significant with jack litter mulch recording maximum stimulatory effect on shoot and root length (220.65 and 167.24 % respectively) followed by Ailanthus (142.75 and 131.86% respectively). Inhibitory effect on shoot length was recorded with mango litter mulch alone. The maximum inhibitory effect of mango mulch remained same for root length too, the order of inhibition

being mango > nutmeg > rubber while all other species litter promoted root growth in comparison with the control.

Tannia: The mulch effects were significant on all growth parameters of tannia seedlings (Table 2). Among the different species, rubber litter was found to record highest significant effects and it was stimulatory on sprouting percentage, shoot length and leaf number followed by jack and cashew. All species reduced root growth and the maximum inhibition was by Ailanthus litter (6.13 %) and least by rubber (93.87 %). Among the different species litter examined, rubber and cashew litter can be recommended as mulch materials in tannia.

The study revealed the species specific allelopathic influences as the effects varied with the litter used and crops tried. These varied effects of litter could be attributed to the differential amounts of indigenous secondary metabolites synthesized and

released from the plant parts (Melkania, 1983) and hence their role in breaking the dormancy in the planting materials. Jack litter was found to have stimulatory effects in the seedling growth in greater yam and tannia while mango had inhibitory effects in both crops. Ailanthus, on the other hand revealed stimulatory effects in greater yam but significant inhibitory effects in tannia. The allelopathic influences of litter observed have earlier been reported in mango (Sahoo *et al.*, 2010), and jack (Kumar *et al.*, 2006; Kato-Noguchi and Takami, 2015). Ailanthus (Heissey, 1999), nutmeg, tamarind and wild jack (Isaac and Nair, 2002) The results of allelopathic potential of aqueous extracts of rubber leachates were strongly inhibitory on leguminous crops (Debnath *et al.*, 2016) while in the present study the litter as mulch recorded stimulatory effects especially in tannia. Singh *et al.* (2009) based on their investigation opined that allelopathic influence also depends on the concentration of allelochemicals in the medium. When litter was used as mulch, there could be a dilution of the allelochemicals after release with irrigation.

The differential responses noticed with the same litter in the two crops may be attributed to the inherent crop species characters. The response of the crop is dependent on how sensitive the species is to the allelochemical released and its concentration. This could be the reason for Ailanthus litter showing varied effects in greater yam and tannia. Variations in the allelopathic effects of the same litter in different crops have documented by authors (Krishna *et al.*, 2005; Zhang and Fu, 2010).

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