

Flowering behaviour and reproductive growth of polyethylene film-mulched groundnut (*Arachis hypogaea*) intercropped with cotton (*Gossypium hirsutum*) under irrigated situation

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ABSTRACT

An experiment was conducted during the winter season of 1999–2000 and rainy season of 2000, to study the flowering behaviour and reproductive growth of polyethylene film-mulched groundnut (*Arachis hypogaea* L.) in sole as well as intercropping with cotton (*Gossypium hirsutum* L.). The effect of polyethylene film mulch (PFM) on days to first flowering, days to produce 50% of total flowers in a single plant, total number of flowers produced, pod setting ratio and total number of matured pods/plant was significant. As a result, the pod yield was also highest with the same treatment (26.17 q/ha and 26.46 q/ha respectively during winters of 1999–2000 and rainy 2000). The effect of intercrop treatments was significant on majority of the phenological and yield characters and pod yield of groundnut. The interaction effect was non-significant during both the seasons for all the parameters studied.

Key words : Groundnut, Polyethylene film, Mulch, Flowers, Pegs, Pod yield

Polyethylene film mulch technology made a revolution in groundnut production, which is popularly known as white revolution in China. Because of the good vegetative growth in polyethylene film-mulched groundnut, more reproductive buds differentiate and bloom early and result in more matured pods/plant (Hu Wenguang *et al.*, 1995). Groundnut raised under broad-bed and furrow system with polyethylene film mulch results in 25% higher pod yield over non-mulched control (Subrahmanian *et al.*, 1999). Though polyethylene film mulch is a high-yielding technology in groundnut, farmers preference is lacking in view of cost of polyethylene film which could be used only for 1 crop. However there is a great scope to increase the per unit productivity in polyethylene film-mulched groundnut by growing another crop in the furrows of broad bed and furrow system of land configuration as intercrop. The slow growing nature of cotton could be exploited for this situation. Hence present study was conducted to study the flowering behaviour and reproductive growth of polyethylene film-mulched groundnut.

MATERIALS AND METHODS

A field experiment was conducted during the winter (*rabi*) season of 1999–2000 and rainy (*khari*) season of 2000 at Regional Research Station, Tamil Nadu Agricultural University, Vridhachalam. The soil was a red sandy loam, low in available N (160 kg/ha), moderate in avail-

able P_2O_5 (37.5 kg/ha) and available K_2O (145 kg/ha), with pH 7.3. The experiment was laid out in randomized block design with 4 replications. The treatments comprised of 3 intercrops, viz. sole groundnut, groundnut + cotton intercrop (simultaneous sowing of cotton and groundnut) and groundnut + cotton intercrop (cotton sown 30 days after groundnut sowing) and 2 mulches (polyethylene film mulch and non-mulched control). The plot size was 27 m² (4.5 m × 6.0 m).

Groundnut was sown in the beds and cotton was sown in the bed in such a way that 3 rows of groundnut in the beds and 1 row of cotton in the furrows. Groundnut + cotton intercrop was grown on additive series where the population of groundnut (3,33,333 plants/ha) and cotton (44,444 plants/ha) was maintained. Transparent polyethylene sheets of 7-micron thickness with holes made in the polyethylene sheets at the required spacing were spread over the soil in the mulched plots and groundnut sowing was done. Seeds of the groundnut 'VRI 2' were dibbled in the holes. Seeds of cotton 'MCU 7' were also dibbled in the polyethylene sheets spread over the soil in the furrows. The entire quantity of fertilizers was applied at the time of sowing for sole groundnut and sole cotton. For the cotton + groundnut, the entire quantity of the recommended dose of groundnut was applied as basal and for cotton half of the dose was applied at the time of sowing and the remaining quantity was applied after the harvest of groundnut. In

the mulched plots, fertilizers and herbicides were applied before spreading the polyethylene film over the soil. No after cultivation was done in both the polyethylene film mulched and non-mulched plots.

To determine the effect of treatments on total flower production, flower count was taken from first day of flowering to cessation of flowering in each treatment. From the total blooming duration, the days required to achieve 50% of the total flower production in a single plant from date of sowing was taken as days to 50% flowering in a single plant. The pegging percentage and pod setting ratio were computed by using the formula suggested by Buang Han Chai and Kyu Yong Chang (1997). To determine effect of treatments on yield, data on matured pods/plant, 100-kernel weight, per cent shelling and pod yield were recorded after the harvest of crop.

RESULTS AND DISCUSSION

Intercrops

No significant difference between the sole crop and intercrops was observed for days to first flowering and days to 50% flowering production/plant (Table 1). Due to slow growth of cotton in the early stages in groundnut + cotton intercrop (simultaneous sowing) treatment and since the cotton was sown 30 days after groundnut sowing in groundnut + cotton intercrop the days to first flowering and 50% flowering was also similar to sole groundnut.

With regard to total flower and total pegs/plant, the results were similar in both sole as well as groundnut + cotton intercrop (cotton sown 30 days after groundnut sowing). However in groundnut + cotton (simultaneous sowing), there was considerable reduction in flower produc-

tion and pegs/plant. Since the groundnut + cotton crop was grown in additive series, the cotton crop would have competed with groundnut for resources and the shading effect of cotton on groundnut crop would have also resulted in decreased rate of flower production and prolonged its duration. Cattani *et al.* (1997) reported similar results in groundnut. Except pegging percentage and matured pods/plant during rainy season 2000, the yield attributes and pod yield (Table 2) were also higher under sole groundnut which was however at par with groundnut + cotton intercrop (cotton sown 30 days after groundnut sowing).

Mulching

In general, the groundnut crop bloomed 4–6 days earlier in polyethylene film mulch treatments (Table 1). The mulching groundnut produced first flower 6 days earlier in winter and four days in rainy season compared to non-mulched treatments. Similar to days to first flowering, days to 50% flowering was also earlier in mulch treatments. Early germination due to increase in soil temperature and humidity and subsequent vigorous growth of groundnut crop might be the reasons for early flowering in the polyethylene film-mulched groundnut. The early synchronized and basal setting of flowers under polyethylene film mulch would have earlier in days to 50% flowering in a single plant. The total flower production was also more under polyethylene film mulch due to the increased rate of progression of flowering from the basal nodes due to early flowering.

Though the pegging percentage was not significantly influenced by (Table 2) mulch treatments (Table 2), polyethylene film mulch treatments significantly improved the

Table 1. Effect of polyethylene film mulch treatments on flower production of groundnut during the winter season 1999–2000 and rainy season 2000.

Treatment	Days to first flowering		Days to 50% flowering in single plant		Total number of flowers/plant (A)		Total pegs/plant (B)		Pegging (%) B/A		Matured pods/plant (C)		Pod setting (%) C/A	
	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season	Winter season	Rainy season
<i>Intercrop</i>														
Sole groundnut	27	23	34.30	34.25	101.00	90.98	52.40	36.00	51.90	39.70	20.15	18.55	19.45	20.33
Groundnut + cotton (simultaneous sowing)	27	23	34.80	34.41	88.90	82.70	36.15	30.70	40.35	37.30	15.70	16.70	17.35	20.06
Groundnut + cotton (cotton sown 30 days after groundnut sowing)	27	23	34.65	34.33	104.00	88.10	50.75	33.30	49.20	37.70	18.45	17.60	17.50	19.77
CD (P=0.05)	NS	NS	NS	NS	6.68	2.44	3.65	3.12	5.11	NS	2.69	NS	NS	NS
<i>Polyethylene film mulch</i>														
Mulched	24	21	33.43	32.94	118.90	98.32	56.13	38.00	47.86	36.03	23.43	21.16	20.03	21.57
Non-Mulched	30	25	35.73	35.72	77.03	76.20	36.73	28.66	47.26	21.16	12.76	14.06	16.50	18.53
CD (P=0.05)	0.91	1.47	0.75	1.41	5.45	1.99	2.98	2.54	NS	NS	2.20	1.46	1.87	1.48

Table 2. Effect of polyethylene film mulch treatments on yield attributes and pod yield of groundnut during winter (rainy) and rainy (*khari*) seasons

Treatment	100 kernel weight (g)		Shelling (%)		Dry pod yield (q/ha)	
	Winter 1999–2000	Rainy 2000 season	Winter 1999–2000	Rainy 2000 season	Winter 1999–2000	Rainy 2000 season
<i>Intercrop</i>						
Sole groundnut	36.80	35.20	66.20	66.00	26.17	26.46
Groundnut + cotton (simultaneous + sowing)	33.65	33.00	63.50	61.15	23.19	22.09
Groundnut + cotton (cotton sown 30 days after groundnut sowing)	35.55	35.00	63.95	64.70	25.15	23.45
CD (P=0.05)	1.75	1.05	NS	2.75	1.30	1.09
<i>Polyethylene film mulch</i>						
Mulched	36.06	35.76	65.83	64.63	29.07	28.39
Non-mulched	34.60	33.23	63.26	63.26	20.60	19.60
CD (P=0.05)	NS	0.85	NS	NS	1.06	0.89

matured pods/plant, pod setting ratio during both the seasons and 100-kernel weight only during winter 2000. The staggered and prolonged blooming period in the non-mulched treatments were the reasons for poor pod setting (%) in non-mulched control. Buong Han Chai and Kyu Yong Chang (1997) observed early flowering initiation by 11–15 days and a higher pegging and pod setting percentage under polyethylene film-mulched groundnut compared to non-mulched groundnut.

As regard to pod yield, polyethylene film mulch registered the highest dry pod yield of 26.17 and 26.46 q/ha, respectively, in winter and rainy seasons. This was on a par with groundnut + cotton (cotton sown 30 days after groundnut sowing) with polyethylene film mulch during winter season 1999–2000. Ghosh *et al.* (1997) observed that early germination (5–6 days) and retention of optimum soil moisture around the root zone under polyethylene films resulted in higher groundnut pod yield over the control.

No significant interaction between different intercrops and polyethylene film mulch was found for all the parameters studied during both the seasons.

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