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Polythene film mulch technology for yield maximization in summer groundnut (*Arachis hypogaea*)

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ABSTRACT

A field experiment was conducted during the post-rainy (summer) season of 1998 and 1999 to study the response of groundnut (*Arachis hypogaea* L.) variety 'ICGS 11' to various layouts and mulches, specially polythene film mulch (PMG). Groundnut yield was not influenced significantly due to different layouts, viz. broad-bed furrow (BBF) and flat bed, however numerically higher pod yield was recorded with BBF. Growth, yield and yield-attributing characters of groundnut were increased significantly due to straw mulch as well as polythene mulched groundnut. The polythene mulched groundnut recorded significantly higher pod yield (4,061 kg/ha), haulm yield (7,274 kg/ha) and kernel yield (2,930 kg/ha) over straw mulch and no mulch groundnut. Under polythene mulch dry pod yield, haulm yield and kernel yield were 19.76%, 4.82% and 21.13% higher over straw mulch groundnut and 41.9%, 13.9% and 44.6% higher over no mulch groundnut. Besides yield increase, polythene mulched groundnut enhanced the pod maturity by 8 days as compared to control.

Key words : Polythene film mulch, Straw mulch, Groundnut, Layouts

India is the largest groundnut-growing country in the world, with an area of about 8.5 m ha. However, the productivity of groundnut in India is very low (855 kg/ha). Use of plastic film mulch for agriculture is at conceptual stage in our country. Transparent and black polythene sheet (50 microns) in groundnut increased soil temperature by 6 to 7°C and as a consequences 70% germination within 2 weeks of planting was obtained as against 22% in control (Basu and Ghosh, 1995). However, there was very little impact on the yields because the sheet were removed after obtaining 100% germination within 3 weeks. Taking a clue from the use of ultra thin (6 to 8 microns) polythene film mulch for revolutionizing groundnut yield in China the present experiment was undertaken.

MATERIALS AND METHODS

A field experiment was conducted during post-rainy season (summer) 1998

and 1999 at Agricultural Research Station, K. Digraj, Sangli. The experiment was laid out in factorial randomized design with 4 replications. The soil of the experiment plot was medium deep black (Vertisols) having organic carbon (0.43%), average N (328 kg/ha), average P_2O_5 (12.4 kg/ha) and average K_2O (337 kg/ha), with pH 8.12. The treatment consisted of 2 layouts, viz. broad bed furrow and flat bed, and 3 mulch treatments, viz. no mulch groundnut, straw mulch with soybean straw @ 5 tonnes/ha and polythene film mulch groundnut. The polythene film used for mulching had 900 mm width, 0.010 mm (10 microns) thickness, > 70% light transmitance and 100% elasticity. Recommended dose of fertilizers 10 tonnes FYM + 25 kg N + 50 kg P_2O_5 was applied through single superphosphate and urea. Groundnut variety 'ICGS 11' was sown in the first week of February during both the years. All other recommend, management practices were followed.

There are 2 methods of application of polythene film mulch, viz. mulch polythene before sowing and mulch ploythene after sowing. In the present study the polythene mulch before sowing method was used, as this method take less time and labour. Herbicide, i.e. Fluchloralin @ 1.5 kg a.i./ha, was sprayed on bed surface. A shallow ditch along the outside edges of the bed was dug and the bed surface was covered with the polythene film and edges of the polythene film were buried on both the side to facilitate the protection to the film against damage by winds. The holes of 4 cm × 5 cm diameter and 3 cm × 4 cm deep were made on the bed at 30 cm × 15 cm spacing with a whole maker or PVC pipe. After irrigation at optimum moisture content seed was sown in the holes.

RESULTS AND DISCUSSION

Effect of layouts on yield and yield attributes

Yield attributes, viz. shelling (%), 100-pod weight, 100-kernel weight and sound mature kernel (%) were not influenced significantly due to layouts. However more shelling (72%), 100-pod weight (113.4 g), 100-kernel weight (45.9 g) and SMK (94.8%) were observed due to broad bed furrow as compared to flat bed.

Dry pod yield of groundnut was increased significantly due to broad bed furrow during 1999, however during 1999 and in the pooled mean there was no significant difference was in the yield. The maximum dry pod yields were obtained due to broad bed furrow during 1998 and 1999 respectively. However, haulm and kernel yields were not influenced significantly due to layouts. Shelk *et al.* (1997) reported difference in the pod yield due to different layouts at Parbhani.

Effect of mulches on yield and yield attributes

Maximum and significantly higher shelling (%), 100-kernel weight and sound mature kernel were observed under polythene mulch groundnut which were 2.7%, 11.6% and 3.6% higher than the control (no mulched groundnut). Buung and Kyu (1997) from Korea reported 2.4 to 4% higher shelling and kernel weight under polythene-mulched groundnut.

Under polythene mulched groundnut maximum and significantly higher dry pod

Table 1. Yield and yield attributes of groundnut as influenced by various layouts and mulches

Treatment	Yield (kg/ha)						Shelling (%)*	100-pod weight (g)*	1,000-kernel weight (g)*	SMK (%)*
	1998		1999		Pooled mean					
	Pod	Kernel	Pod	Kernel	Pod	Kernel				
Layout										
Broad bed furrow	3,840	2,748	3,409	2,456	3,624	2,596	71.1	106.8	43.0	94.3
Flat bed	3,782	2,712	2,772	1,978	3,276	2,347	71.5	101.7	44.0	94.0
CD (P=0.05)	NS	NS	370	122	NS	NS	NS	4.9	NS	NS
Mulch										
Non-mulched groundnut	3,349	2,361	2,375	1,700	2,862	2,026	70.5	104.0	41.1	92.6
Straw mulched groundnut	3,844	2,762	3,012	2,163	3,428	2,458	71.9	104.4	43.5	93.4
Polythene mulched groundnut	4,240	3,068	3,884	2,791	4,061	2,930	72.4	105.3	45.9	95.1
CD (P=0.05)	138.9	108	211	150	478	319	0.42	NS	3.13	1.73
General mean*	3,811	2,730	3,090	22,18	3,451	2,471	71.6	104.2	43.5	94.1
Interaction*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	3.35	3.68	6.27	6.34	7.06	6.57	1.3	5.83	6.61	2.67

*Pooled mean

Table 2. Economics of the groundnut as influenced by various layouts and mulches

Treatment	Gross returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)*	Benefit : cost ratio
Layout				
Broad bed furrow	54,096	11,013	43,083	4.91
Flat bed	49,312	10,527	38,785	4.68
CD (P=0.05)	NS			
Mulche				
Non-mulched groundnut	43,260	10,091	33,169	4.29
Straw mulched groundnut	51,335	10,819	40,516	4.45
Polythene mulched groundnut	60,501	13,894	46,607	4.35
CD (P=0.05)	6,653			
Ground mean	51,698	11,601	40,097	4.35
Interactions	NS			

yield was observed which was 19.76 and 41.89% higher than straw mulch and control respectively. Haulm yield was higher by 4.82% and 13.87% and kernel yield by 21.13% and 44.62% over straw mulch and control respectively. The NRC G (1995) reported 63% higher groundnut pod yield than the control due to combination of wheat straw and polythene mulch (thick polythene mulch was kept up to pod-development stage only). Buung and Kyu (1997) reported that pod yield was 44% higher and kernel yield was 56% higher over no mulch groundnut. Hu *et al.* (1995) reported 20–50% higher groundnut yield under polythene mulch groundnut over the control. Trials conducted at different 9 locations during 1999 under AICRP on groundnut revealed that on an average yield increase due to PMG was 29.7% (NRCG, 1998).

Application of soybean straw mulch @ 5 tonnes/ha increased dry pod yield by 19.78% over the control (Table 1). Ghorai (1994) reported 56% yield increase of groundnut due to application of straw mulch @ 10 tonnes/ha.

Table 3. Rates of inputs and outputs used for calculations of economics

Input/output	Rate (Rs/kg)
Polythene film mulch	70.00
Soybean straw mulch	0.50
FYM	1.00
Single superphosphate	5.50
Urea	6.60
Fluchloralin	340.00
Groundnut dry pods	12.00
Groundnut dry haulms	1.00

Economics

The maximum gross returns, net returns and benefit : cost were recorded due to broad bed furrow as compared to flat bed. Under polythene mulched groundnut maximum gross returns and net returns were recorded, however, maximum benefit : cost ratio was recorded under straw mulch followed by polythene mulch groundnut.

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