Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-6: 1769-1773

EXCELLENT PUBLISHERS

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 Special Issue-6 pp. 1769-1773
Journal homepage: http://www.ijcmas.com

Original Research Article

Efficacy of Polyethylene Mulch Technology in Improving Growth, Flowering Behavior and Yield of Irrigated Pigeonpea in Andhra Pradesh

Y.M. Swathi, M. Srinivasa Reddy, G. Prabhakara Reddy and P. Kavitha

Department of Agronomy, Acharya N.G. Ranga Agricultural University, Tirupati, Andhra Pradesh, India

**Corresponding author*

Keywords

Days to maturity, Drip, Growth attributes, Pattern of sowing, Polyethylene film mulch, Reproductive growth

A B S T R A C T

An experiment was conducted during late *kharif*, 2016-17 at Agricultural College Farm, Mahanandi under drip irrigation to study the growth, flowering behavior and yield of polyethylene film mulch pigeonpea. The effect of polyethylene mulch on growth characters like plant height, stem girth, dry matter production, leaf area index, pod bearing branches plant^{-1}, days to 50% flowering, days to maturity was significant. Earlier flowering and maturity has seen. As a result, reproductive growth characters like number of pods plant^{-1}, pod yield^{-1} and seed yield was higher under plastic mulch when compared to planting without mulch

Introduction

The importance of pulses is much more in country like India, where majority of the people are vegetarian. Pigeonpea (*Cajanus cajan* (L) Millsp.) is the fifth prominent pulses crop in the world and second most important grain legume of India after chickpea. Pigeonpea is considered to be a drought tolerant crop owing to its deep and extensive root system, which enables to absorb more water from deeper soil layers. However, it still suffers from moisture stress as evident from low to very low yields of *kharif* crop in drought years. The yield potential of pigeonpea can be realized only through efficient utilization of solar radiation and mitigating terminal drought for which canopy size and shape claim a paramount importance among the agronomic practices. Water is an indispensable, finite and scarce natural resource. With the decline of water table and shortage of available water, pigeonpea as rainfed crop and is prone to water stress. One of the possible ways of increasing its productivity is through drip irrigation and polyethylene film mulch. At the same time, the need to meet increasing demand for food will require increased production per unit of water. Mulch can improve water productivity and yield through increase in water retention. Mulch enhance moisture availability period, reduce evaporation loss of water and maintain soil temperature. However, in India use of plastic film as mulch in agricultural field is still at a conceptual stage. Congenial environmental conditions determine the growth and flowering behavior of pigeonpea. Because of good vegetative growth in pigeonpea, more reproductive buds differentiate and bloom early under plastic film. Keeping the aforesaid issues, the study was performed to outbreak the effect on the growth, flowering behavior and yield of pigeonpea with polyethylene film mulch.

Materials and Methods

The field experiment was conducted during late *kharif* season of 2016-17 at Agricultural College Farm, Mahanandi. The soil was sandy loam, low in organic carbon (0.3 per cent) and available nitrogen (156 kg ha^{-1}), high in available phosphorus (28 kg ha^{-1}) and potassium (856 kg ha^{-1}) with neutral pH 7.2. The experiment was laid out in randomized block design with nine treatments and three replications. The treatments comprised of sowing with at 120 cm × 20 cm spacing (T_1), sowing with 90 cm × 20 cm spacing (T_2), sowing with 60 cm × 20 cm spacing (T_3), sowing with spacing of 180/60cm × 20 cm as paired rows (T_4), sowing with spacing of 120/60cm × 20 cm as paired rows (T_5), sowing with spacing of 90/30cm × 20 cm as paired rows (T_6), sowing with spacing of 180/60 cm × 20 cm as paired rows with plastic mulch in pairs (T_7), sowing with spacing of 120/60 cm × 20 cm as paired rows with plastic mulch in pairs (T_8) and sowing with spacing of 90/30 cm ×20 cm as paired rows with plastic mulch in pairs (T_9). Surface drip irrigation system was used in the study with an application rate of 6.6 mm hr^{-1}. The dripper lines are placed in each plot at 1 m apart in normal planting and in paired row planting the dripper lines are placed within the paired rows. The black-silver LDPE sheet of 25 µ thickness was used as mulch. It was laid out before establishment of the crop by cutting into pieces. Before laying the mulch sheet, small circular holes were made with scissors at 20 cm space. The sheet was spread within paired rows of crop, above the lateral line. Afterwards all the sides of the mulch sheet were buried into the soil to a depth of 5 cm. Common surface drip irrigation was given to the crop as and when required. Five plants were tagged at random in net plot area for recording various observations on growth characters like plant height, stem girth, dry matter production, leaf area index, pod bearing branches $plant^{-1}$.

To determine the effect of treatments on flowering behaviour, the days required to achieve 50% of the total flower production from net plot area from date of sowing was taken as days to 50% flowering.

The number of days when 80-85 per cent of the pods got matured and dried up was considered as days to physiological maturity. To determine the effect of treatments on pods $plant^{-1}$, pod yield $plant^{-1}$ (g) and seed yield of pigeonpea were recorded after the harvest of crop.

Results and Discussion

Effect on growth attributes

The data on plant morphogenic characters *viz.*, plant height, stem girth, leaf area index at 120 DAS, dry matter production at harvest, pod bearing branches $plant^{-1}$, days to 50% flowering, days to maturity, pods $plant^{-1}$, pod yield $plant^{-1}$ and seed yield are presented in Table 1 and 2. Spacing of 180/60 cm x 20 cm as paired rows with plastic mulch in pairs (T_7) produced maximum plant height (153.1 cm) and stem diameter (1.54 cm) at all crop growth stages. Under excessively high density, plant height do not increase and even tends to decrease because the plants compete for other growth affecting parameters than light.

Table.1 Growth parameters of irrigated pigeon pea as influenced by density, pattern of sowing and mulching

Treatments	Plant height (cm)	Stem girth (cm)	LAI at 120 DAS	Total dry matter production (kg/ha)	Number of pod bearing branches $plant^{-1}$ at harvest
T_1 - Sowing with 120 cm × 20 cm spacing	132.0	1.26	2.37	7656	12.85
T_2 - Sowing with 90 cm × 20 cm spacing	127.4	1.35	3.02	7327	12.67
T_3 - Sowing with 60 cm × 20 cm spacing	135.4	1.23	4.07	8108	11.40
T_4 - Sowing with spacing of 180/60cm × 20 cm as paired rows	142.0	1.36	2.51	7872	14.20
T_5 - Sowing with spacing of 120/60 cm × 20 cm as paired rows	142.0	1.31	2.70	8226	13.52
T_6 - Sowing with spacing of 90/30 cm × 20 cm as paired rows	133.6	1.35	4.28	8351	13.23
T_7 - Sowing with spacing of 180/60 cm × 20 cm as paired rows with plastic mulch in pairs	153.1	1.54	2.62	9074	16.46
T_8 - Sowing with spacing of 120/60 cm × 20 cm as paired rows with plastic mulch in pairs	141.5	1.47	3.20	9128	15.54
T_9 - Sowing with spacing of 90/30 cm × 20 cm as paired rows with plastic mulch in pairs	144.8	1.34	4.36	8455	14.60
SEm±	5.00	0.08	0.21	222.07	0.92
CD(P=0.05)	NS	NS	0.65	665.80	2.76

Table.2 Effect of density, pattern of sowing and plastic mulch treatments on flowering behavior and yield of pigeonpea

Treatments	Days to 50% flowering	Days to Maturity	Number of pods $plant^{-1}$	Pod yield $plant^{-1}$ (g)	Seed yield (kg/ha)
T_1 - Sowing with 120 cm × 20 cm spacing	90	153	259	73	1,548
T_2 - Sowing with 90 cm × 20 cm spacing	90	153	284	87	1,770
T_3 - Sowing with 60 cm × 20 cm spacing	90	153	226	70	1,793
T_4 - Sowing with spacing of 180/60cm × 20 cm as paired rows	88	153	319	101	1,858
T_5 - Sowing with spacing of 120/60 cm × 20 cm as paired rows	88	153	327	104	1,864
T_6 - Sowing with spacing of 90/30 cm × 20 cm as paired rows	88	153	291	97	1,960
T_7 - Sowing with spacing of 180/60 cm × 20 cm as paired rows with plastic mulch in pairs	79	143	411	122	2,210
T_8 - Sowing with spacing of 120/60 cm × 20 cm as paired rows with plastic mulch in pairs	78	143	445	142	2,302
T_9 - Sowing with spacing of 90/30 cm × 20 cm as paired rows with plastic mulch in pairs	78	143	367	113	2,104
SEm±	1.23	2.17	15.6	2.74	143.5
CD(P=0.05)	3.69	6.50	46.9	8.24	430.3

Wider spacing of 180/60 cm x 20 cm with plastic mulch in pairs (T_7) recorded maximum stem diameter perhaps due to increased photosynthate supply to stem under low plant population Mallikarjun *et al.,* (2015) was also in same view.

Significant LAI (4.36) was recorded with paired row spacing of 90/30 cm × 20 cm with plastic mulch in pairs (T_9) and was equal with paired row spacing of 90/30 cm × 20 cm (T_6) (4.28) at 120 DAS. Total dry matter production per unit area depends on number of plants per unit area and dry matter production per plant. Significantly higher dry matter production was recorded with spacing of 120/60 cm × 20 cm as paired rows with plastic mulch in pairs (T_8) (9128 kg ha^{-1}) and it was on par with 180/30 cm × 20 cm as paired rows with plastic mulch in pairs (T_7) (9074 kg ha^{-1}). This was attributed to the better utilization of available growth resources like moisture, nutrients and solar radiation by the well-developed root system.

This facilitated the photosynthetic ability of crop leading to greater biomass production under silver-black polyethylene film. Similar increase in dry matter production with increase in plant density was also reported by Gajera *et al.,* (1998), Ghadage *et al.,* (2005).

Flowering Behavior and Reproductive growth

In general, the pigeonpea crop bloomed 9-10 days earlier in plastic mulch treatments (Table 2). Early germination due to increase in soil temperature and humidity and subsequent vigorous growth of pigeonpea crop might be the reasons for early flowering in mulching treatments resulting in early synchronized flowering. All the treatments with plastic mulch (T_7, T_8 and T_9) were statistically similar irrespective of density of sowing. Similar trend was followed in paired row spacings (T_4, T_5 and T_6) and geometries (T_1, T_2 T_3). In similar way, crop matured 7 days earlier in plastic mulch treatments (T_7, T_8 and T_9) (153 DAS). Early germination, vigorous crop growth, early flowering, podding of pigeonpea crop might be the reason for early maturity in mulching treatments. Variation in number of days taken to reach 50% flowering and maturity in relation to variable plant density were also reported by Varma (1985) and Mahajan *et al.,* (2007).

Maximum number of pod bearing branches $plant^{-1}$ (16.46) was recorded at a spacing of 180/60 cm × 20 cm as paired rows with plastic mulch in pairs (T_7). This might be due to production and translocation of more photosynthates into the economic parts as a result of lesser competition for intercepted light and due to greater availability of space per plant, improved micro climate. 120/60 cm × 20 cm as paired rows with plastic mulch in pairs (T_8) (445) and with spacing of 180/60 cm × 20 cm as paired rows with plastic mulch in pairs (T_7) (411) recorded significantly higher number of pods $plant^{-1}$. Thick stands were reported to increase mutual shading affecting number of flowers per branch and finally decreasing the number of pods $plant^{-1}$. Higher pod yield $plant^{-1}$ (142 g) was recorded at an intermediate spacing of 120/60 cm × 20 cm as paired rows with plastic mulch in pairs (T_8) and was significantly superior to all other treatments. Increase in spacing enhanced the individual plant performance. Further, it might have improved the rate of photosynthesis, dry matter accumulation and its translocation to pods as referred in terms of higher values of growth and yield components that resulted in higher pod yield $plant^{-1}$ of irrigated pigeonpea with wider row spacing.

Yield

The higher seed yield of irrigated pigeonpea was recorded at a spacing of 120/60 cm × 20 cm as paired row with plastic mulch in pairs (2,302 kg ha^{-1}) which was comparable with a spacing of 180/60 cm × 20 cm as paired row with plastic mulch in pairs (T_7) (2,210 kg ha^{-1}), spacing of 90/30 cm × 20 cm as paired rows with plastic mulch in pairs (T_9) (2,104 kg ha^{-1}) and superior over rest of treatments and lowest was recorded with spacing of 120 cm × 20 cm (T_1) (1,548 kg ha^{-1}).

It might due to better growth and yield attributing characters, synchronized flowering, maximum uptake of NPK, along with this it was benefited by mulch which alters microclimate with drip irrigation. The increase in yield attributes under different treatments of mulch might be due to favorable environment and these results are in accordance with those reported by Gajera *et al.,* (1998). The staggered and prolonged blooming period in the non-mulched treatments were the reasons for poor pod formation and lesser yield.

It is concluded that polyethylene film mulch in pigeonpea with paired row spacing could be an important agricultural practice to augment pigeonpea productivity besides improving micro-climatic conditions.

References

Gajera, M.S., Ahlawat, R.P.S and Ardeshna, R.B. 1998. Effect of irrigation schedule, tillage depth and mulch on growth and yield of winter pigeonpea (*Cajanus cajan* (L.) Millsp.). Indian Journal of Agronomy. 43(4): 689-693.

Ghadage, H.L., Pawar, V.S and Gaikwad, C.B. 2005. Influence of planting patterns, irrigation techniques and mulches on growth, yield, water use and economics of cotton (*Gossypium hirsutum*) under irrigated conditions of Western Maharashtra. Indian Journal of Agronomy. 50 (2): 159-161.

Mahajan, G., Rakesh, S., Ashwani, K and Singh, K.G. 2007. Effect of plastic mulch on economizing irrigation water and weed control in baby corn sown by different methods. African Journal of Agricultural Research. 2 (1): 19-26.

Varma, R.H. 1985. Response of redgram varieties to different plant densities under late sown rainfed conditions. *M.Sc. (Ag.) Thesis* submitted to the Andhra Pradesh Agricultural University, Hyderabad.