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RESEARCH PAPER

Dry matter production, it's partitioning, yield and nitrogen addition to the soil through leaf litter of hybrid pigeonpea

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Abstract : In the present investigation, transplanted hybrid pigeonpea recorded significantly higher seed yield as compared to dibbled hybrid pigeonpea. Significantly higher yield obtained under transplanted method was due to positive association between yield attributing characters. At harvest, total dry matter production plant^{-1} was significantly higher with transplanted method as compared to dibbled hybrid pigeonpea. Higher total dry matter production plant^{-1} with transplanting was due to higher dry matter accumulation in stem, leaves and reproductive parts over dibbling at different growth stages. Planting geometry of 120 cm × 90 cm produced significantly higher seed yield over 90 cm × 30 cm and 90 cm × 60 cm.

Key Words : Planting methods, Planting geometry, Dry matter production, Hybrid pigeonpea, Yield

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INTRODUCTION

Pigeonpea (*Cajanus cajan*) is an important multi-use shrub legume of the tropics and subtropics. It is the preferred pulse crop in dryland areas where it is intercropped or grown in mixed cropping systems with cereals or other short duration pulses. It finds an important place in the cropping system adopted by small farmers in most of the developing countries. Globally pigeonpea ranks sixth in area and production in comparison to other seed legumes such as beans, peas and chickpea. It improves soil fertility through biological nitrogen fixation as well as recycling of the nutrients through large quantity of leaf litter. The plant owes a large measure of its popularity to the fact that, it possesses valuable properties as restorative of nitrogen to the soil and adds lot of organic matter to the soil and thus, pigeonpea finds a promising place in crop rotation and crop mixtures. The deep rooting system helps in extracting the nutrients and moisture from deeper soil layers, thus, making it suitable for rainfed conditions. Deeper root system of the crop also helps in breaking the plough pans and improving soil structure and hence, it is called as biological plough.

MATERIAL AND METHODS

The field experiment was conducted at Agricultural Research Station, Annigeri (Dharwad, Dist), during *Kharif* 2011 with the objective of to study the dry matter

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production, its partitioning, yield of hybrid pigeonpea and estimation of nitrogen addition to the soil through leaf litter. The details of materials used and techniques employed during the course of investigation are presented here. Recently released pigeonpea hybrid ICPH-2671 and ruling variety Maruthi (ICP 8863) were taken during this study. For studying the dry matter production and its partitioning, plant samples were collected at 60, 120 DAS and at harvest. At each sampling, two plants were uprooted at random in each treatment and partitioned into leaf, stem and reproductive parts. These samples were oven dried at 70°C in hot air oven for 72 hours till it attained a constant weight. The dry weight of different plant parts were recorded, the total dry matter production plant^{-1} was obtained with the summation of dry weight of all plant parts and was expressed on per plant basis (g plant^{-1}) and for estimation of nitrogen addition to the soil through leaf litter microkjeldhal unit was used as described by Tandon (1998). For the estimation of nitrogen in plant samples, 0.5 g of powdered sample was digested with concentrated sulphuric acid in the presence of digestion mixture ($CuSO_4$ + K_2SO_4 + Selenium powder) till it turned blue. The digested sample was distilled with excess of 40 per cent sodium hydroxide and the ammonia released was trapped in 2 per cent of boric acid and ammonium tetra borate thus formed was titrated against 0.1N H_2SO_4.

Statistical analysis :

The obtained data was analyzed by statistical significant at P<0.05 level, S.E. and C.D. at 5 per cent level by the procedure given by (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Dry matter production, its distribution and other growth parameters :

Dry matter production and its partitioning into reproductive parts depends on the photosynthetic capacity of the plant which in turn depends on the dry matter accumulation in leaves, leaf area and leaf area index. Significantly higher dry matter accumulation in leaves was recorded in transplanting (36.4 g plant^{-1}) as compared to dibbling (31.0 g plant^{-1}) at 120 DAS. The

Table 1 : Growth parameters of hybrid pigeonpea as influenced by planting methods and geometry at 120 DAS

Parameters	Planting methods														S.E. ±	C.D. (P=0.05)
	Dibbled 120 DAS							Transplanted 120 DAS								
	S_1	S_2	S_3	S_4	S_5	S_6	Mean	S_1	S_2	S_3	S_4	S_5	S_6	Mean		
Leaf area/plant (dm^2)	10.3	9.8	12.6	11.3	13.9	14.0	12.0	13.8	13.5	16.2	14.9	17.0	17.6	15.5	0.6	1.8
Leaf area index (LAI)	0.379	0.183	0.156	0.315	0.193	0.130	0.226	0.512	0.250	0.200	0.415	0.237	0.164	0.296	0.013	0.037
Stem girth (cm)	5.67	5.90	6.23	5.80	6.13	6.53	6.04	6.20	6.63	6.97	6.73	6.80	7.13	6.74	0.09	0.27
Canopy spread (cm)	50.5	51.5	56.6	52.8	57.4	60.3	54.8	54.3	56.0	66.3	57.6	63.8	68.3	61.0	1.2	3.5
Root biomass (g)	20.1	21.6	22.1	20.3	22.5	23.1	21.6	32.3	34.0	34.3	32.8	34.1	35.5	33.8	0.7	2.2
Total dry matter production (g)	109.3	118.1	132.5	123.7	129.0	139.3	125.3	122.5	130.2	147.8	137.0	142.2	152.9	138.7	1.5	4.4
Dry matter accumulation in stem (g)	66.8	68.4	71.0	68.2	70.3	74.0	69.7	70.2	74.1	76.2	73.7	75.0	78.1	74.5	0.7	2.2
Dry matter accumulation in leaves (g)	25.0	27.6	34.0	31.1	33.0	35.3	31.0	32.0	33.1	39.2	35.0	38.2	41.0	36.4	0.6	2.0
Dry matter accumulation in reproductive part (g plant^{-1})	92.2	135.3	178.7	138.0	167.3	183.0	149.0	110.3	160.7	215.3	171.0	197.7	218.0	178.8	0.8	2.4

S_1-(90 cm × 30 cm), S_2-(90 cm × 60 cm), S_3-(90 cm × 90 cm), S_4- (120 cm × 30 cm), S_5-(120 cm × 60 cm), S_6- (120 cm × 90 cm) dry matter accumulation in leaves was to the tune of 17.47 per cent over dibbling. The similar trend was noticed in all the growth stages of transplanted hybrid pigeonpea. The higher dry matter accumulation in leaves was due to more number of leaves plant^{-1} and more leaf area plant^{-1}. These results are in accordance with findings of Pavan *et al.* (2009) and Poornima *et al.* (2009).

In the present investigation, significantly higher dry matter accumulation in leaves was due to higher leaf area index in transplanted hybrid pigeonpea over dibbled hybrid pigeonpea. Significantly higher leaf area index (Table 1) at harvest was recorded with transplanted hybrid pigeonpea (0.198) over dibbled hybrid pigeonpea (0.128). Higher leaf area index was mainly depends on the leaf area plant^{-1} and higher leaf dry weight plant^{-1}. Significantly higher leaf area plant^{-1} (10.0 dm^2) and leaf dry weight (26.8 g plant^{-1}) at harvest was recorded with transplanted hybrid pigeonpea over dibbled hybrid pigeonpea (Table 1). Similar trend was noticed at 60 and 120 DAS. 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. More dry matter accumulation in leaves was further supported by higher root biomass, canopy spread and plant height (Table 1).

Yield and yield parameters :

In general the production potential of hybrids per unit area is higher as compared to the varieties. To meet the food and other demands of ever increasing population, it is an inevitable to produce more crop yields per unit area. The pigeonpea hybrid ICPH-2671 is recently released from ICRISAT which is a high yielder compared to existing varieties. In the present study, the transplanted hybrid pigeonpea recorded significantly higher (1899 kg ha^{-1}) seed yield (Table 2) as compared to dibbled hybrid pigeonpea (1376 kg ha^{-1}). The yield increase due to transplanting was to the tune of 27.54 per cent. Significantly higher yield obtained under transplanted method was due to positive association between yield attributing characters *viz.,* number of seeds pod^{-1}, pod weight plant^{-1} and seed weight plant^{-1} compared to dibbling method. Significantly higher number of seeds pod^{-1} (3.52 pod^{-1}), pod weight plant^{-1} (178.8 g plant^{-1}) and seed weight plant^{-1} (126.7 g plant^{-1}) were recorded in transplanted method compared to dibbling method (3.43 pod^{-1}, 149.0 g plant^{-1} and 104.7 g plant^{-1}, respectively) and was higher to an extent of 2.62, 19.96 and 21.05 per cent, respectively over dibbling method. This might be due to early planting of pigeonpea seedlings and also availability of natural resources very effectively *viz.,* solar radiation, soil moisture, space, and nutrients. These results are in accordance with the findings of Pavan *et al.* (2009); Potdar *et al.* (2010) and Salakinkoppa and Patil (2010) in pigeonpea. They reported that higher seed yield of pigeonpea with transplanted method over dibbling was due to improved growth and yield contributing parameters.

Addition of nitrogen through leaf litter :

Among the planting methods, transplanted hybrid pigeonpea recorded significantly higher addition of nitrogen (Table 2) through leaf litter (21.1 kg ha^{-1}) as compared to dibbled hybrid pigeonpea (19.3 kg ha^{-1}). Within the different planting geometries, significantly higher addition of nitrogen through leaf litter was recorded with planting geometry of 90 cm × 30 cm (21.6 kg ha^{-1}) followed by 120 cm × 30 cm (21.3 kg ha^{-1}) and 90 cm × 60 cm (20.6 kg ha^{-1}) as compared to rest of the planting geometry. Among the interactions, the treatment combination of transplanting + 90 cm × 30 cm was recorded significantly higher addition of nitrogen through leaf litter (22.6 kg ha^{-1}) followed by transplanting +120 cm×30 cm (22.1 kg ha^{-1}) and

Table 2 : Yield of hybrid pigeonpea and nitrogen addition to soil through leaf litter as influenced by planting methods and geometry at harvest

Parameters	Planting methods														S.E ±	C.D. (P=0.05)
	Dibbled							Transplanted								
	S_1	S_2	S_3	S_4	S_5	S_6	Mean	S_1	S_2	S_3	S_4	S_5	S_6	Mean		
Yield (kg/ha)	1279	1375	1419	1360	1390	1431	1376	1549	1622	2082	1990	2017	2136	1899	7	23
Number of seeds pod^{-1}	3.20	3.43	3.60	3.23	3.50	3.63	3.43	3.33	3.43	3.67	3.47	3.53	3.70	3.52	0.05	NS
Pod weight plant^{-1}	92.2	135.3	178.7	138.0	167.3	183.0	149.0	110.3	160.7	215.3	171.0	197.7	218.0	178.8	0.8	2.4
Seed weight plant^{-1}	64.8	94.7	129.0	92.7	116.1	130.8	104.7	77.5	112.6	152.0	119.8	142.2	156.3	126.7	0.6	1.9
Addition of nitrogen to soil (kg/ha)	20.7	19.7	18.3	20.4	19.0	18.0	19.3	22.6	21.4	19.9	22.1	20.7	19.7	21.1	0.2	0.6

S_1-(90 cm × 30 cm), S_2-(90 cm × 60 cm), S_3-(90 cm × 90 cm), S_4- (120 cm × 30 cm), S_5-(120 cm × 60 cm), S_6 - (120 cm × 90 cm); NS=Non-significant transplanting + 90 cm × 60 cm (21.4 kg ha^{-1}) as compared rest of the treatment combinations (Vibha *et al.*, 2012 and Thirathon *et al.*, 1987).

The control, cv. MARUTI under dibbled condition recorded significantly lower addition of nitrogen through leaf litter (14.9 kg ha^{-1}) as compared to transplanted and dibbled hybrid pigeonpea (21.1 and 19.3 kg ha^{-1}, respectively) and cv. MARUTI under transplanted condition (16.6 kg ha^{-1}).

REFERENCES

Gomez, K.A. and Gomez, A.A. (1984). *Statistical procedures for agricultural research*. A Willey International publication, John Willey and Sons, NEW YORK, U.S.A.

Pavan, A.S., Nagalikar, V.P., Halepyati, A.S. and Pujari, B.T. (2009). Effect of planting on the yield, yield components and economics of transplanted pigeonpea. *Karnataka J. Agric. Sci*, **22**(2) : 433-434.

Poornima, D.S., Shankaralingappa, B.C. and Sheshadri, T. (2009). Studies on feasibility of transplanting pigeonpea in sole cropping and finger millet based intercropping system. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Bangalore, KARNATAKA (INDIA).

Potdar, M.P., Chittapur, B.M., Salakinkoppa, S.R., Sharma, Arjun and Dharmraj, P.S. (2010). Response of transplanted pigeonpea (*Cajanus cajana* L.) to planting geometry under rainfed conditions of North Eastern dry zone of Karnataka. National Symposium on *Resource management approaches towards livelihood security*, 2-4 December, Bengaluru, KARNATAKA (INDIA).

Salakinkoppa, S.R. and Patil, H.Y. (2010). Enhancing the productivity of pigeonpea by transplanting technique in command area. National symposium on *Food security in context of changing climate*, Kanpur, 133pp.

Thirathon, A., Blyth, D.E., Fischer, K.S. and Whiteman, P.C. (1987). Relationship between leaf area, radiation interception and dry matter production after flowering in short season pigeonpea. *Australian Center for Intenational Agric. Res.*, 252-253.

Vibha, Jha, P.K. and Nidhi (2012). Effect of an introduced beneficial inocula of native and exotic bioagents on microbial and dominant fungal population in pigeonpea rhizosphere of calciorthent soil. *Internat. J. agric. Sci.*, **8**(2): 329-334.