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Effect of drip fertigation levels and plant growth regulators on growth and yield of transplanted redgram (*Cajanus cajan*)

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Abstract

The field trial was conducted during *rabi*, 2019 at Water Management Research Block, Department of Agronomy, Agricultural College and Research Institute, Madurai to study the influence of drip fertigation levels and growth regulators on growth and yield of transplanted redgram. The experiment was laid out in a randomized block design with ten treatments and replicated thrice. The treatments include two levels of drip fertigation; 100% and 125% RDF (25:50:25 kg NPK/ha) with foliar spraying of 2% DAP, 1% triaccontanol, 200 ppm mepiquat chloride and 100 ppm cycocel on 45 and 60 DAP. Among the treatments, drip fertigation of 125% RDF at weekly interval in equal splits from 15 to 90 DAP with foliar spraying of 2% DAP recorded higher plant height (174.9cm) and a number of branches per plant (35.8). It also proved its significance by recording the maximum grain yield (1539 kg/ha) and stalk yield (13,678 kg/ha) which was 37.4% higher than grain yield obtained under drip fertigation of 100% RDF to transplanted red gram.

Keywords: Transplanted red gram, drip fertigation, foliar nutrition and yield

Introduction

Pigeonpea is the second most important pulse crop in India after chickpea. It is commonly known as redgram, tur or arhar and it is rich in protein (20-25%). It is also an important pulse crop in Tamil Nadu, occupying 41.38 ha area, 51.64 tonnes production and with average productivity of 1248 kg/ha (Directorate of economics and statistics, 2018 – 2019). More than 85% of redgram area is under rainfed condition. The area under pulse crop is increasing but its productivity is low. The reason for decreased productivity is due to a decrease in soil fertility, imbalanced use of fertilizers and appearance of physiological disorders like indeterminate growth habit, excess flower abscission (70-95%), poor source sink relationship, poor pod setting and short of nutrients at critical stages leading to poor growth and productivity. To overcome these restrictions, an additional supplement of nutrients is necessary for increasing the pod yield in pulses. Foliar application of nutrients at proper stages of crop growth enhances root development and nodulation, increasing pod setting and yield. It reduces the cost of cultivation by lowering the fertilizer loss. Foliar nutrition and drip fertigation improves both water and fertilizer use efficiency to a great extent. These technologies help to increase in branches/plant, nodule/plant, pods/plant which ultimately increases the yield. Transplanting is a technique suggested for the delayed onset of the monsoon. It involves raising healthy and vigorous seedlings in protrays for 20-25 days and then planting in the main field to maintain optimum plant population. Hence the present study was taken to evaluate the effect of drip fertigation levels and foliar nutrition on growth and yield of transplanted redgram.

Materials and Methods

The field experiment was conducted at the Water Management research block, Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during *rabi*, 2019. The experimental field is located in the Southern agro climatic zone of Tamil Nadu with 9°54' N latitude and 78°54' E longitude with an altitude of 147 m above mean sea level. The experiment was laid out in a randomized block design with ten treatments and three replications.

The treatments were T₁-drip fertigation of 100% RDF (25:50:25 kg NPK/ha), T₂ - drip fertigation of 100% RDF + foliar spraying of DAP @ 2%, T₃ - drip fertigation of 100% RDF + foliar spraying of Mepiquat chloride @ 200 ppm, T₄ - drip fertigation of 100% RDF + foliar spraying of Triacantanol @ 1%, T₅ - drip fertigation of 100% RDF + foliar spraying of Cycocel @ 100 ppm, T₆ - drip fertigation of 125% RDF, T₇ - drip fertigation of 125% RDF + foliar spraying of DAP @ 2%, T₈ - drip fertigation of 125% RDF + foliar spraying of Mepiquat chloride @ 200 ppm, T₉ - drip fertigation of 125% RDF + foliar spraying of Triacantanol @ 1%, T₁₀ - drip fertigation of 125% RDF + foliar spraying of Cycocel @ 100 ppm.

The test crop of this trial was redgram Co (Rg) 7. The experimental soil was sandy clay loam. Healthy seeds were selected and treated with thiram @ 2 g/kg. The seedlings were raised in portrays (50 cone) for 25 days and transplanted in the main field with 75 x 30 cm spacing under drip irrigation system. Drip irrigation was given once in three days at 100 PE and fertigation was given at a weekly interval from 15 to 90 DAP. The RDF of 25:50:25 kg NPK ha⁻¹ was followed in which P was applied as basal and NK were fertigated. The foliar nutrition was given at 45 and 60 DAP. The observations were made on growth parameters, yield attributes and yield.

Result and Discussion

Plant height

Drip fertigation levels and foliar spraying of plant growth regulators had a significant influence on plant height of transplanted red gram during all the growth stages of the crop. Plant height of the crop was initially increased slowly, thereafter it showed significant differences on 90 DAP, due to foliar application at 45 and 60 DAP.

The maximum plant height (174.9 cm) was recorded with fertigation of 125% RDF and foliar spraying of 2% DAP (T₇) which was on par with 125% RDF + 1% triacantanol (T₉) and the minimum plant height was recorded with fertigation of 100% RDF alone (149.2 cm). Among the plant growth regulators, triacantanol @ 1% had positive influence on plant height whereas mepiquat chloride @ 200 ppm and cycocel @ 100 ppm have decreased the plant height. Foliar spraying of DAP at 2% resulted in better vegetative growth due to more and quick access to nutrients by plants at early development stages in pulse crops (Uma Maheswari *et al.*, 2017)^[4]. Foliar application of triacantanol improves the morphogenetic response in the embryogenesis process in a plant. This might cause an increase in the speed of cell division to produce maximum growth (Sitinjak *et al.*, 2014)^[9].

It also enhanced the growth and yield of agronomic and horticultural crops under normal and stressful condition (Naem *et al.*, 2011)^[7]. Decrease in plant height under CCC and mepiquat chloride application may be attributed to the hindrance in gibberellic acid biosynthesis and these observations were in close agreement with findings of Jeyakumar and Thangaraj (1996)^[2], Dhaka and Anamika (2003)^[1] and Sachin *et al.*, 2019^[8].

Number of branches per plant

Both drip fertigation levels and growth regulators exhibited significant difference in the number of branches per plant. The highest number of branches per plant was observed with 125% RDF + DAP @ 2% (35.8) followed by 125% RDF + cycocel @ 100 ppm (33.0) at harvest and the lowest number of branches per plant was recorded with 100% RDF alone (25.0). The effect of cycocel might have suppressed the

vegetative growth resulted in better utilization of carbohydrates and its effective translocation ultimately resulted in more number of branches (Uma Maheswari *et al.*, 2017)^[4].

Yield attributes and yield

The number of pods per plant was found to be maximum with drip fertigation of 125% RDF along with 2% DAP spray followed by 125% RDF with cycocel @ 100 ppm foliar application and the lowest pods per plant was registered with fertigation of 100% RDF alone. The yield attributes of red gram like number of seeds per pod, pod length and test weight were not much influenced by drip fertigation and foliar nutrition. Significantly the highest grain yield (1539 kg ha⁻¹) and stalk yield (3678 kg ha⁻¹) were recorded under drip fertigation of 125% RDF and foliar spraying of 2% DAP (T₇) which was followed by fertigation of 125% RDF + cycocel @ 100 ppm. The yield increment under T₇ over control (T₁) is 37.4%. Application of DAP @ 2% at flowering and pod development stage improved the absorption and translocation of nutrients which intern to increase the grain yield in red gram (Solaiappan *et al.*, 2002)^[10]. Similar results were concluded by Mathan *et al.*, (1996)^[6] and Marimuthu and Surendran (2015)^[5] in black gram. The production of higher seed yield might be also due to growth regulators reminded physiologically more active to build up sufficient food reserves for developing flowers and seeds. An increase in the grain yield with cycocel treatment may be attributed to the reduction in plant height which was found to be useful for increasing the efficiency of translocation of food material towards seed filling (Mohamadali Doddamani *et al.*, 2010)^[3].

Table 1: Growth regulators and fertigation levels on growth parameters of transplanted redgram

Treatments	Plant height (cm)				Number of branches			
	30 DAP	60 DAP	90 DAP	Harvest	30 DAP	60 DAP	90 DAP	Harvest
T1	54.3	82.9	116.4	149.20	8.3	10.5	16.4	25.0
T2	57.7	90.7	120.1	151.60	8.9	13.1	20.1	29.1
T3	57.7	71.3	104.2	136.77	8.5	12.0	18.8	27.5
T4	57.9	86.2	119.0	150.90	8.6	12.6	19.3	28.2
T5	59.3	81.2	115.1	148.80	8.8	12.8	19.6	28.7
T6	60.0	100.3	131.0	162.00	9.0	13.4	20.9	29.8
T7	62.0	112.4	142.6	174.90	9.5	20.2	27.5	35.8
T8	60.8	83.2	117.5	149.60	9.1	13.7	21.4	30.0
T9	62.7	110.0	142.0	174.53	9.3	15.8	22.2	30.7
T10	63.4	84.1	118.7	150.50	9.4	17.3	24.6	33.0
SEd	2.51	4.27	5.03	5.65	0.35	0.59	0.88	1.08
CD(P=0.05)	5.28	8.97	10.56	11.86	0.73	1.25	1.84	2.27

Table 2: Growth regulators and fertigation levels on yield attributes and yield of transplanted red gram

Treatments	Pods/plant	No. of seeds/pod	Test weight (g)	Grain yield (kg/ha)	Stalk yield (kg/ha)
T1	173	3.81	9.55	1120	2330
T2	192	4.02	9.73	1223	2731
T3	181	4.11	10.02	1155	2473
T4	185	3.85	9.94	1167	2526
T5	189	4.01	10.01	1188	2682
T6	198	4.02	10.31	1274	2933
T7	218	4.25	10.75	1539	3412
T8	199	3.99	10.13	1308	2954
T9	201	4.03	10.39	1383	3021
T10	210	4.40	10.42	1462	3221
SEd	3.31	-	-	25.1	61.49
CD (P=0.05)	6.94	NS	NS	72.6	129.13

Conclusion

The overall results revealed that drip fertigation of 125% RDF at weekly interval from 15 to 90 DAS along with foliar application of DAP @ 2% was found to be the best treatment for improving the growth and yield of transplanted red gram compared to fertigation of 100% RDF alone. However, this study will help to enhance the yield by reducing the flower drop and identify the effective nutrient management strategy for transplanted red gram which will give the maximum benefit to the farmers by increasing the productivity and economic returns.

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