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Effect of drip fertigation on resultant seed quality of long duration Pigeon pea crop (*Cajanus Cajan*)

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Abstract

The field experiments were conducted at Krishi Vigyan Kendra, Kundrakudi Sivaganga District during two seasons to study the effect of drip fertigation on seed quality of long duration pigeon pea (*Cajanus cajan* L.) (LRG 41) crop variety. The experiment includes combination of water and nutrients levels. Three irrigation regimes (50%, 75% and 100% WRC (computed water requirement of crop) and surface irrigation) and three fertilizer levels (with conventional fertilizers and water soluble fertilizers) formed the treatment combinations. The results revealed that drip irrigation and fertigation treatments responded well to pigeon pea resultant seed quality. In the treatment T₉, drip irrigation with 100 per cent water requirement of crop with application of 125 per cent recommended dose of fertilizer (RDF) through water soluble fertilizers recorded the maximum seed quality parameters viz., germination percentage (97% mean of two years), root length (17.65 cm), shoot length (13.8 cm), dry matter production (5.1 g plant⁻¹) and vigour index (3085.5) of pigeon pea crop compared to T₁₄ control treatment recorded lowest seed quality index viz., germination percentage (60% mean of two years), root length (13.15 cm), shoot length (9.95 cm), dry matter production (5.1 g plant⁻¹) and vigour index (1387.5), respectively. Increased nutrient availability coupled with optimum moisture supply through drip fertigation system to the pigeon pea crop consequently led to better formation and translocation of assimilates from source to sink as they play vital role in various biochemical processes for seed quality.

Keywords: Pigeon pea, drip fertigation, seed quality parameter, vigour index

Introduction

Pigeon pea is one of the important protein rich grain legumes of semi-arid tropics grown throughout the tropical and sub tropical regions of the world. India is the largest producer and consumer of pigeon pea. In Tamil Nadu pulses can be raised both in rainfed and irrigated conditions. The pulses crops being grown in Tamil Nadu are pigeon pea, green gram, black gram, cowpea, horse gram, Bengal gram, cowpea, peas & beans etc. But the major area under pulses are covered by black gram, green gram and red gram.

Seed deterioration is a serious problem in developing countries where seeds are usually stored in places without a proper control of humidity and temperature. Temperature and seed moisture content (and/or relative humidity) are the main factors influencing seed deterioration and viability loss in storage (Abbas *et al.*, 2014) ^[1]. Seed ageing is generally marked by reduction in vigor (Gupta and Aneja, 2004) ^[8], viability, rate and capacity of germination (Arefi and Abdi, 2003) ^[4], increased solute leakage (Basra *et al.*, 2003) ^[6] and susceptibility to stresses and reduced tolerance to storage under adverse conditions. High seed vigor, that is rapid, uniform and complete emergence of vigorous seedling, leads to high grain yield potential of crop, by enhancing the establishment of optimum canopy structure that minimizes interplant competition and maximizes crop yield. In Tamil Nadu, pigeon pea is grown in an area of 48314 ha with a production of 45198 and productivity of 926 kg ha⁻¹ (Season and Crop Report, 2021-22) ^[12]. Pigeon pea is sown mainly under rainfed conditions. It constitutes about 6 per cent of the total area under pulses. In Tamil Nadu, major red gram growing districts are Dharmapuri, Krishnagiri and Tirupathur which together share about 61per cent of the total area under this crop during 2021-22.

There has been a high degree of risk in pulses production due to monsoon failures, low seed multiplication ratio and deficient in soil nutrient levels which results in shrinking of area. This

necessitates the need to develop proper agronomical practices including quality seed production to increase the productivity. Currently 6 per cent of the total pulses area in Tamil Nadu is irrigated. Crop productivity was increased were the availability of soil moisture and the availability of crop nutrients. Drip fertigation is a precision technique that enables accurate supply of water and nutrients to meet the crop requirements. Keeping this in view, the present study was made to find the effect of different irrigation regimes and fertigation levels on seed quality of pigeon pea.

Materials and Methods

The field experiments were conducted during *khairf* season of 2016 and 2017 at farmers' field of Sevenipatty village of Thirupathur block, Sivaganga District to study the effect of drip fertigation on seed quality of long duration pigeon pea (LRG 41) crop variety. The experiments were laid out in a randomized block design with fourteen treatments and three replications. The experiment includes combination of three irrigation regimes (50%, 75% and 100% WRc (computed water requirement of crop) and surface irrigation) and three fertilizer combination levels (with conventional fertilizers and water soluble fertilizers). The treatments comprises T₁- 50% computed water requirement of crop (WRc) + 75% recommended dose of fertilizers (RDF 25:50:25 NPK kg ha⁻¹) through water soluble fertilizers (WSF), T₂- 75% WRc + 75% RDF (WSF), T₃- 100% WRc + 75% RDF (WSF), T₄- 50% WRc + 100% RDF (WSF), T₅-75% WRc + 100% RDF (WSF), T₆- 50% WRc + 125% RDF (WSF), T₇- 100% WRc + 100% RDF (WSF), T₈- 75% WRc + 125% RDF (WSF), T₉- 100% WRc + 125% RDF (WSF), T₁₀- 50% WRc + 100% RDF through conventional fertilizers (CF), T₁₁- 75% WRc + 100% RDF (CF), T₁₂- 100% WRc + 100% RDF (CF), T₁₃- 100% WRc (Drip) + 100% RDF through conventional fertilizers applied as basal and T₁₄- Surface Irrigation + 100% RDF through conventional fertilizers (All basal). The other agronomic recommendation practices were followed as per the TNAU, Coimbatore.

The seed were examined for quality characters such as germination, root length, shoot length, dry matter production and vigour index of red gram. The hundred seeds were placed for germination in roll towel media of four replicates and were kept in a germination room maintained at 25±1°C and 90±3% RH (ISTA, 1999) [9]. After the germination period of 6 days, the test was terminated and evaluated. Based on normal seedlings, the germination was recorded in percentage. During the germination count, ten seedlings were randomly selected and measured for their root and shoot length and dry matter production. Dry matter production is calculated ten normal seedlings in each of replications were taken at random, air dried for 24 hours and dried in a hot air oven maintained at 85 °C±1 for 24 hours and cooled in desiccators for 30 minutes, weighed. The vigour index values were also computed as these are the expression of total seed quality characters (Abdul Baki and Andreson, 1973) [3]. The data obtained were subject to analysis of variance and tested for significance according to Panse and Sukhatme (1995) [11] and the percentage values were transformed to arcsine values prior to statistical analysis.

Results and Discussion

In the present investigation, drip irrigation and fertigation had positive influence on the seed qualities compared to surface irrigation were shown in Table 1 and 2. The seed quality characters viz., germination, root length, shoot length; dry matter production and vigour index were positively influenced by the various treatments. Treatment T₉ drip fertigation with 100 per cent WRc along with application of 125 per cent recommended

dose of fertilizer through water soluble fertilizers and this treatment recorded the maximum seed quality parameters in terms of germination percentage (97% mean of two years), and it on par with T₆ treatment (92%) and other treatments viz., T₈, T₅, T₇, T₃; whereas in root length there was no significant difference among the treatments. Maximum shoot length was recorded in the T₉ treatment (13.8 cm), followed by treatment T₆ (12.8 cm) and comparable with different treatments T₈, T₅, T₇, T₃, T₄, T₂ and T₁, respectively. Whereas T₉ registered higher dry matter production (5.1 g plant⁻¹) followed by treatment T₆ (4.9 g plant⁻¹) and also followed by other treatments viz., T₈, T₅, T₇, T₃ and T₄ respectively. With respect to vigour index, T₉ registered highest vigour index (3085.5 mean of two years) followed by T₆ treatment (2802). Whereas T₁₄ control treatment recorded lowest seed quality index viz., germination percentage (60% mean of two years), root length (13.15 cm), shoot length (9.95 cm), dry matter production (5.1 g plant⁻¹) and vigour index (1387.5), respectively. Increased nutrient availability coupled with optimum moisture supply through drip fertigation system to the pigeon pea crop consequently led to better formation and translocation of assimilates from source to sink as they play vital role in various biochemical processes. This might have enhanced the resultant seed quality parameter under drip fertigation system.

Table 1: Effect of drip irrigation and fertigation on germination percentage and root length of resultant seed quality of pigeon pea

Treatments	Germination (%)			Root length (cm)		
	2016	2017	Mean	2016	2017	Mean
T ₁	70 (56.79)	74 (59.34)	72	14.9	15.2	15.05
T ₂	76 (60.66)	80 (63.43)	78	15.5	15.8	15.65
T ₃	80 (63.43)	84 (66.42)	82	15.7	16	15.85
T ₄	76 (60.66)	80 (63.43)	78	15.7	16	15.85
T ₅	84 (66.42)	88 (69.73)	86	16	16.4	16.2
T ₆	90 (71.56)	94 (75.82)	92	17.5	17.8	17.65
T ₇	82 (64.89)	86 (68.02)	83	15.8	16.1	15.95
T ₈	88 (69.73)	92 (73.57)	90	16.5	16.9	16.7
T ₉	96 (78.46)	98 (81.87)	97	17.5	17.8	17.65
T ₁₀	64 (53.13)	68 (55.55)	66	14.6	14.9	14.75
T ₁₁	66 (54.33)	70 (56.79)	68	14.3	14.6	14.45
T ₁₂	72 (58.05)	76 (60.66)	74	15.3	15.6	15.45
T ₁₃	64 (53.13)	68 (60.66)	66	13.6	13.9	13.75
T ₁₄	58 (49.60)	62 (51.94)	60	13	13.3	13.15
S Ed	7.59	7.57		NS	NS	
CD (P=0.05)	16.29	16.25				

Note: values in parenthesis are original values

Table 2: Effect of drip irrigation and fertigation on dry matter production, shoot length and vigour index of pigeon pea

Treatments	Shoot length (cm)			DMP (g/plant)			Vigour Index		
	2016	2017	Mean	2016	2017	Mean	2016	2017	Mean
T ₁	10.9	11.2	11.05	3.6	4	3.8	1804	1955	1879.5
T ₂	11.1	11.4	11.25	3.9	4.3	4.1	2015	2173	2094.0
T ₃	11.2	11.5	11.35	4.1	4.5	4.3	2150	2311	2230.5
T ₄	11.1	11.4	11.25	4.1	4.5	4.3	2033	2192	2112.5
T ₅	12.1	12.4	12.25	4.5	4.9	4.7	2360	2528	2444.0
T ₆	12.6	13	12.8	4.7	5.1	4.9	2712	2892	2802.0
T ₇	11.7	12.1	11.9	4.1	4.5	4.3	2257	2423	2340.0
T ₈	12.5	12.8	12.65	4.6	5	4.8	2556	2731	2643.5
T ₉	13.6	14	13.8	4.9	5.3	5.1	2991	3180	3085.5
T ₁₀	10.5	10.8	10.65	3	3.4	3.2	1604	1749	1676.5
T ₁₁	10.5	10.9	10.7	3.3	3.7	3.5	1641	1786	1713.5
T ₁₂	11	11.3	11.15	3.6	4	3.8	1889	2043	1966.0
T ₁₃	10.3	10.7	10.5	3	3.4	3.2	1531	1671	1601.0
T ₁₄	9.8	10.1	9.95	2.6	3	2.8	1322	1453	1387.5
S Ed	1.46	1.45	-	0.59	0.58	-	271.5	298.4	-
CD (P=0.05)	3.12	3.10	-	1.28	1.24	-	582.6	640.1	-

Conclusion

It is concluded that drip irrigation and fertigation of 100 per cent WRc along with 125 per cent RDF was found to be the best treatment combination in terms of resultant seed quality parameters as compared to surface irrigation.

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