

Effect of Seed Hardening with Chemicals on Drought Tolerance Traits and Yield in Chickpea. (*Cicer arietinum*. L)

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Abstract

A field experiment was conducted to study the effect of seed hardening with various chemicals on bio-chemical components and yield in chickpea. (*Cicer arietinum*. L).during *Rabi* 2007,under rain fed conditions. Significantly higher seed yield was recorded in seed hardening with CaCl_2 -2% (26.32q per ha.) followed by Cycocel -1000ppm (23.54 q per ha.) and succinic acid 20ppm (23.44 q per ha.) as compare to control (19.04q per ha.). The increased seed yield in seed hardening with CaCl_2 -2% may be attributed to increase in the total chlorophyll, chl-a. and chl-b chlorophyll stability index, proline content ,relative water content, coupled with lower of specific leaf area. as compare to control. Thus It indicates that seed hardening modifies the physiological and biochemical nature of seeds so as to get the characters that are favorable for drought tolerance which more so with CaCl_2 -2%. Further, It is also evident from the results that the increased seed yield in seed hardening with CaCl_2 -2% is associated with the increased morpho- physiological traits like plant height ,Number of leaf lets, leaf dry matter and total dry matter accumulation, leaf area per plant and Harvest index.

Keywords: Seed hardening, Chickpea CaCl_2 , Cycocel, Succinic acid

1. Introduction

Chickpea (*Cicer arietinum*.L.) is a major *Rabi* season pulse crop in southern peninsular India. It is generally grown on conserved moisture and moisture in the soil profile gradually recedes as the crop grows. As a consequence, plant experiences progressively increasing degree of terminal moisture stress. Thus, soil moisture stress assuming a major limiting factor for determining the growth and yield of chickpea (Verma and Pramalakumari , 1978). Therefore there is a need to identify suitable ameliorative measures to overcome the moisture stress effect.. The pre-sowing seed hardening with chemicals is one of the simple technique being employed to modify the marpho-physio-biochemical nature of seed, so as to induce the characters that are favorable for drought resistance. Keeping these views the investigation was under taken to study the effect of seed hardening chemicals on growth and yield in chickpea.

2. Materials and methods

2.1 Material treatment and experiment design

A field experiment was conducted during *rabi* 2007 at college of agriculture farm UAS, Dharwad, under rain fed conditions. The trial was laid out in RBD with three replications. A day before sowing, seeds of Chickpea variety, ICCV-2 were soaked for three hours separately in water, and solution of CaCl_2 (1% and 2%), KH_2PO_4 -1%, KNO_3 -100ppm, KCL- 0.1%, Sodiummolybdate-100ppm, Zinc sulphate-100ppm, Cycocel-1000ppm, succinicacid-20ppm, Ascorbic acid- 20ppm. Later seeds were dried under shade and used for sowing.

2.2 Determination growth and physio- biochemical observations

The plant height was recorded from base of the plant to tip of the main stem. The leaf are per plant was computed by graphic method. Number of leaf lets, Total dry matter and its distribution in leaf stem and reproductive parts were worked out from the tagged five plants and average was computed and presented on per

plant basis. The total chlorophyll, Chl-a and Chl-b were estimated by using disulphoxide solvent as described by Hiscox and Isrelstam (1979) and was expressed as mg per g of fresh weight.. The free proline content was estimated as per Bates et al (1973).The relative water content (RWC) was estimated by method described by Barrs and Weatherly (1962). The determination of epi- cuticular content in leaf at 80DAS was done as per Eberson et al (1977) and was quantified by the help of standard curve drawn by using cabowax-3000 and was expressed as mg per dm².

3. Results and discussions

3.1 Morpho-physiological parameters

The data on morpho-physiological parameters of chickpea revealed, significantly higher plant height (48.1cm) in seed hardening with CaCl₂ -2% ,where as lower plant height in cycocel-1000ppm.This clearly indicates mode of action differs for the chemicals studied. Similarly in finger millet seed hardening with CaCl₂ 2% improved the plant height and was due to redistribution of resources leading to cell enlargement and cell division (Karivartharaju and Ramkrishna (1985). The mechanism of reduction in plant height in seed hardening with Cycocel-1000ppm to be due to reduced cell size and cell thickening (Ginzo-1977).Similar results were reported by Dighe et all.1983 in Wheat. . Increase in TDM, ,leaf dry matter, stem dry matter and redistribution of dry matter in reproductive parts is noticed with seed hardening with CaCl₂-2% as compare to control.. In addition ,more number of leaf lets and leaf area is also more with seed hardening with CaCl₂-2%.Thus, TDM and its partition and leaf area were important parameters to boosting the source sink relationship, which is evident from the improvement in the yield and yield parameters. (Table 1).

3.2 Biochemical parameters

The data on biochemical parameters of chickpeaTable-2) as influenced by seed hardening chemical revealed, significantly higher chlorophyll content, chl-a, and chl-b in seed hardened with Cycocel1000ppm followed by succinic acid 20ppm and CaCl₂-2% as compare to Control. It may be due to maintenance of cell turgidity, denser cytoplasm and inhibition of chlorophyll breakdown. In addition, significantly higher Chlorophyll stability index, higher relative water content, proline content and epicuticular wax coupled with lower SLA. is being recorded in seeds hardened with CaCl₂-2% followed by Cycocel 1000ppm and succinic acid 20ppm. Similar results have been noticed by Cheema,et al (1975), in barley and wheat Shasidhar et al (1981) in Ground nut and Ramesh (2004) in sorghum. Who reported increase in RWC, Chlorophyll and Proline in seed hardened plants?

3.3 Yield and yield attributes

Significantly higher seed yield was recorded in seed hardening with CaCl₂-2%(26.32q/ha) followed by Cycocel-1000ppm (23.54q/ha.) and Succinic acid -20ppm (23.44q/ha.) over control.(Table-3). The increase in the yield in seed hardening with CaCl₂-2% may attributed to increase in the yield components mainly 100 seeds weight., seed yield per plant and harvest index and acquisition of drought tolerance traits general.. However control recorded lower yield and lower mean value for yield components. The results are in agreement with the findings of Mishra and Dwivedi,(1980), Who reported that treating wheat seeds with 0.25% CaCl₂ or 2.5% KCl increased the grain yield compare to control. On the other hand increased drought tolerance and grain yield in sorghum over control under dry condition was reported by Patil et al. (1987).

4. Conclusion

The pre sowing seed hardening with CaCl₂ -2% improved yild of chickpea .over control. This simple technique may be employed by the growers to realize the potential yield.

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Table 1. Effect of seed hardening chemicals on morho- physiological traits in chickpea

Treatments	Plant height (Cm)	No.of Leaf lets per plant at 80DAS	Leaf area at 80 DAS (cm ²)	Leaf Dry matter (g/Pl.)	Stem dry matter (g/Pl.)	Total dry matter (g/Pl.)
T ₁ : Control	40.6	201.7	393	1.48	4.05	22.2
T ₂ : Water soaking	43.5	216.0	408	1.85	4.92	26.5
T ₃ : CaCl ₂ (1%)	43.7	210.3	403	1.35	5.11	24.6
T ₄ : CaCl ₂ (2%)	48.1	298.0	492	2.16	8.14	36.1
T ₅ : KH ₂ PO ₄ (1%)	44.7	247.7	438	1.96	5.64	30.6
T ₆ : KNO ₃ (100 ppm)	46.0	297.0	456	20.9	6.16	31.6
T ₇ : KCl (100 ppm)	45.0	222.0	432	1.48	4.26	27.8
T ₈ : Sodium molybdate (100 ppm)	43.8	231.7	405	1.98	5.04	26.0
T ₉ : Zinc sulphate (100 ppm)	44.7	256.0	438	2.00	5.13	27.1
T ₁₀ : Cycocel (1000 ppm)	39.6	285.0	399	2.08	7.43	32.7
T ₁₁ : Succinic acid (20 ppm)	40.3	269.0	399	2.02	7.78	30.9
T ₁₂ : Ascorbic acid (20 ppm)	45.6	239.3	444	1.93	5.07	27.8
S. E	0.91	8.9	12.5	0.06	0.37	1.57
CD at (5%)	2.63	25.6	36.2	0.17	0.95	4.53

Table 2. Influence of seed hardening chemicals on biochemical components in chickpea

Treatments	Relative water content (%)	Chlorophyll Stability index(%)	Proline content mg per g	SLW at 80 DAS g/cm ² LA	Epi cuticular wax mg / dm ²	Chl- a .mg/g .	Chl-b mg/g	Total Chloro Phyll mg / g
T ₁ : Control	46.9	51.8	217	5.09	0.423	0.47	0.13	0.60
T ₂ : Water soaking	50.6	53.1	250	5.54	0.446	0.59	0.15	0.74
T ₃ : CaCl ₂ (1%)	50.8	55.2	258	5.02	0.550	0.52	0.14	0.66
T ₄ : CaCl ₂ (2%)	59.0	79.2	312	7.52	0.673	0.86	0.18	1.04
T ₅ : KH ₂ PO ₄ (1%)	53.4	67.5	283	6.26	0.535	0.80	0.17	0.97
T ₆ :KNO ₃ (100 ppm)	54.7	70.5	303	7.13	0.490	0.85	0.18	1.03
T ₇ :KCl (100 ppm)	51.6	57.6	276	5.65	0.473	0.54	0.13	0.68
T ₈ : Sodium molybdate (100ppm)	52.6	56.50	254	5.63	0.470	0.75	0.16	0.91
T ₉ : Zinc sulphate(100 ppm)	53.2	64.4	284	5.23	0.484	0.79	0.17	0.95
T ₁₀ : Cycocel (1000 ppm)	56.9	76.3	312	8.80	0.627	1.07	0.21	1.28
T ₁₁ :Succinic acid (20 ppm)	55.0	71.5	275	8.65	0.571	0.91	0.18	1.10
T ₁₂ : Ascorbic acid (20 ppm)	54.7	62.0	287	6.33	0.531	0.86	0.17	1.03
S. E	1.95	2.6	12.2	0.50	0.027	0.08	0.012	0.086
CD (5%)	5.59	7.5	35.3	1.44	0.079	0.23	0.034	0.250

Table 3. Influence of seed hardening chemicals on yield and yield traits in chickpea.

Treatments	Seed yield (g plant ⁻¹)	100 seed weight (g)	Harvest index (%)	Seed yield (q ha ⁻¹)
T ₁ : Control	9.12	26.64	41.1	19.04
T ₂ : Water soaking	11.11	28.69	42.0	19.41
T ₃ : CaCl ₂ (1%)	11.58	29.22	47.1	19.12
T ₄ : CaCl ₂ (2%)	19.15	30.77	53.1	26.32
T ₅ : KH ₂ PO ₄ (1%)	13.48	26.66	44.0	22.02
T ₆ :KNO ₃ (100 ppm)	13.77	30.33	43.6	23.73
T ₇ :KCl (100 ppm)	12.85	24.89	46.2	20.65
T ₈ : Sodium molybdate (100 ppm)	12.63	24.52	48.6	21.71
T ₉ : Zinc sulphate (100 ppm)	13.2	26.36	48.7	22.34
T ₁₀ : Cycocel (1000 ppm)	16.10	27.70	49.2	23.54
T ₁₁ :Succinic acid (20 ppm)	14.67	27.20	47.5	23.44
T ₁₂ : Ascorbic acid (20 ppm)	12.96	26.63	46.6	22.45
S E	0.62	0.73	2.05	1.16
CD at (5%)	1.81	2.11	5.95	3.38