Studies on Climate Smart Intervention on Induction of Drought Tolerance by Seed Priming with CaCl$_2$ in Chickpea Growth, Yield and Quality Parameters

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A B S T R A C T

The present investigations were carried out in NICRA village (Melakunda B) of Krishi Vigyan Kendra (KVK), Kalaburagi to study the influence of drought tolerance by seed priming with CaCl$_2$ (2%) in chickpea growth, yield and quality parameters during 2017-18 under rainfed condition. The result reveal that, seed treatment with CaCl$_2$ (2%) recorded higher plant height (43.7 cm), leaf dry matter (2.15 g/plant), stem dry matter (7.14 g/plant), total dry matter (36.2 g/plant), total number of pods (48.7 pods/plant), seed yield (13.7 q/ha) and higher seed quality parameters like seed germination (94.8 %), root length (10.7 cm), seedling vigour (1564.2) and field emergence (91.7 %) compared to control under drought condition.

Keywords
Chickpea, Drought tolerance, CaCl$_2$, Seed yield, Seed priming, Seedling vigour

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Introduction

In India, nearly 70% of cultivated land is rainfed and accounts about 42% of the total quantity of food grains produced. The low productivity under rainfed condition is due to soil moisture deficit, low and erratic rainfall, use of poor quality seeds, poor crop establishment and improper crop management. Seed treatment with CaCl$_2$ is a practice adopted to alleviate the moisture stress or making the plant resistant to moisture stress through proper germination and crop establishment under drought situations. There are several studies done to show the beneficial effects of presowing seed treatment with CaCl$_2$ in different crops. For example, Pothiraj and Sankaran (1984) and Rathinavel and Dharmalingam (2000) in cotton; Pawar et al., (2003) in sunflower; Parvatikar et al., (1975), Sheela and Alexander (1995) in rice; Singh et al., (1975) in barley. Also there are reviews done by Kulkarni and Chittapur (2003) and Solaimalai and Subburamu (2004) on seed treatment with CaCl$_2$ (2%) in different crops. The inorganic salts like NaCl, Na$_2$SO$_4$, KCl, KH$_2$PO$_4$, CaCl$_2$ and MgSO$_4$; organic acids like succinic acid, CCC and...
auxins are used as prehardening agents. Seed treatment with CaCl\(_2\) will modify the physiological and biochemical nature of seeds, so as to get the characters that are favorable for drought tolerance. Although, it varies from crop to crop, the principle remains same.

Chickpea (Cicer arietinum L.) is a major Rabi season pulse crop in Hyderabad-Karnataka region. 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, yield and quality parameters in chickpea (Verma and Pramilakumari, 1978). Therefore there is a need to identify suitable ameliorative measures to overcome the moisture stress effect. The pre-sowing seed treatment with CaCl\(_2\) is one of the simple technique being employed to modify the morpho-physio-biochemical nature of seed, so as to induce the characters that are favorable for drought resistance. Keeping these views the investigation was undertaken to study the influence of drought tolerance by seed priming with CaCl\(_2\) (2%) on growth, yield and quality parameters in chickpea.

**Materials and Methods**

An field demonstration were conducted to study the influence of drought tolerance by seed priming with CaCl\(_2\) (2%) in chickpea growth, yield and quality parameter during 2017-18 under rainfed condition in NICRA village (Melakunda B) of Krishi Vigyan Kendra (KVK), Kalaburagi to Annual rainfall received was 720 mm during the year 2017-18.

The experiments consist of two treatments i.e control and seed priming with CaCl\(_2\). A day before sowing, the chickpea seeds were soaked in solution of CaCl\(_2\) (2%) for six hours and later seeds were dried under shade to its original moisture. The seeds were sown in field by following all the normal chickpea packages of practices includes agronomic practices and plant protection measures for the crop.

To know the effect of seed soaking on germination and early seedling vigour, 100 seeds were sown in each plot. The germination count was taken from these plots. From this the percentage germination was worked out.

The seedlings were thinned out at 8 days. The observations on percent germination, root length, seedling vigour, 100 seed weight and field emergence were recorded at the beginning of crop growth. The observations on leaf dry matter, stem dry matter, total dry matter, total number of pods per plant and seed yield recorded after harvest of crop.

**Results and Discussion**

Rainfall: Ten days dry spell observed prior to sowing and after sowing i.e., between 22/10/2018 to 31/10/2018. The data shows that after sowing up to 10 days there was no rainfall received and hence there was moisture stress at germination and seedling growth in the chickpea field.

In the present study, seed priming with CaCl\(_2\) (2%) under drought condition recorded significantly higher plant height (43.7 cm), leaf dry matter (2.15 g/plant), stem dry matter (7.14 g/plant), total dry matter (36.2 g/plant), seed yield (13.7 q/ha) and higher seed quality parameters like seed germination (94.8 %), root length (10.7 cm), seedling vigour (1564.2) and field emergence (91.7 %) compared to control.

The improvement in germination by seed priming with CaCl\(_2\) (2%) under drought
condition lead to physicochemical changes within the cytoplasm leading to improvement in seed germination, seed viability, vigour, root length, shoot length and also yield parameters in chickpea crops has been recorded (Solaimalai and Subbaramu, 2004) and reviewed by many workers (Rathinavel and Dharnalingraju, 2000; Kulkarni and Chittapur, 2003). Many studies on the improvement of growth and yield due to pre sowing seed treatment with CaCl₂ are documented (Solaimalai and Subbarmanu, 2004; Meek and Oosterhugs, 2005). Soaking the seeds for 24 hours in CCC under saline condition results an increase in seed cotton yield (Gabr and Ashkar, 1977) (Fig. 1; Table 1 and 2).

**Fig.1** Influence of rainfall on seed primming with CaCl₂ in chickpea growth, yield and quality parameters in NICRA village KVK, Kalaburagi

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**Table.1** Period of dry spell after seed primming with CaCl₂ in chickpea growth, yield and quality parameters in NICRA village KVK, Kalaburagi

| Rainfall 2017-18 | March | April | May | June | July | August | September | October |
|------------------|-------|-------|-----|------|------|--------|-----------|--------|
| No. of dry spells during 2017-18 | >10 days | - | - | 1 | - | - | - | 1(dry spell) i.e (10 days) after chickpea sowing |
| | >15 days | 2 | - | 1 | - | - | - | - |
| | >20 days | - | - | - | - | - | - | - |
| No. of Rainy Days | 2 | - | 1 | 6 | 8 | 12 | 6 |
| No. Intensive Rain- Spells (2017) | >60 mm per day | 1 | - | - | 1 | 1 | 1 | 1 |
Table 2: Effect of seed priming with CaCl\(_2\) and yield trait in Chickpea under drought condition

| Dry spell period                  | Particulars                        | Control       | Seed treatment with CaCl\(_2\) demonstration plot |
|-----------------------------------|------------------------------------|---------------|--------------------------------------------------|
| Dry spell from 22/10/2018 to 31/10/2018 (10 days) | 1) Plant height (cm)           | 42.2          | 43.7                                              |
|                                   | 2) Leaf dry matter (g/plant)      | 1.78          | 2.15                                              |
|                                   | 3) Stem dry matter (g/plant)      | 5.13          | 7.14                                              |
|                                   | 4) Total dry matter (g/plant)     | 32.4          | 36.2                                              |
|                                   | 5) Total number of pods/plant     | 43.5          | 48.7                                              |
|                                   | 6) Seed yield (g/pl)              | 12.18         | 15.63                                             |
|                                   | 7) 100 Seed weight (g)            | 21.46         | 24.67                                             |
|                                   | 8) Seed germination (%)           | 86.5          | 94.7                                              |
|                                   | 9) Root length (cm)               | 8.9           | 10.7                                              |
|                                   | 10) Seedling vigour               | 1376          | 1564.2                                            |
|                                   | 11) Field emergence (%)           | 87.4          | 91.7                                              |
|                                   | 12) Seed yield (q/ha)             | 12.2          | 13.7                                              |

The improvement in yield and yield parameters in pulse crops has been attributed to the beneficial effects of seed priming with CaCl\(_2\) due to increased bound water content, triggering of biosynthesis of nucleic acids and rapid germination and growth of seedlings resulting in increased uptake of nutrients and the ability of the treated seeds to withstand high temperature for prolonged periods under dry condition (Swaminathan and Sujatha, 2001).

The pre-sowing seed treatment with CaCl\(_2\) - 2% improved yield and seed quality parameters of chickpea over control. This simple technique may be employed by the growers to realize the potential yield and seed quality parameters.

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