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Effect of Varying Temperatures on Seed and Seedling Vigour in Bold Seeded Chickpea Genotypes

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Summary

Chickpea (*Cicer arietinum* L.) known by the common names Bengal gram, gram, homes, garbenzobean is traditionally grown in parts of the world covering Asia, Africa, Europe, North and south America but the bulk of it is produced and consumed in South countries. In India Chickpea is a prime pulse crop of rabi. The present study was performed to see the performance of high yielding bold seeded chickpea genotypes for seed vigour under varying temperature conditions. Performance of five highest yielding bold seeded chickpea under different temperature conditions revealed that 25º C - 30º C temperature was optimum for various seed/seedling vigour tests for chickpea as compared to other temperatures, at which the testing was done.

Introduction

Chickpea (*Cicer arietinum* L.) belongs to genus *Cicer,* tribe Cicereae, family Fabaceae, and sub family Papilionacea. It originated in South Eastern Turkey (Ladizinsky, 1975). The name *Cicer* is of Latin origin, derived from the greek word 'Kikun' meaning force or strength. Duschak (1871) traced the origin of the work to the Hebrew 'kirkes' where 'Kikar' means sound. The word *arietinum* is also Latin, translated from the Greek 'Krios' another name for both ram and Chickpea, an allusion to the shape of the seed which resembles the head of a ram (Aries) (Van der Maesen, 1987).

It is a crop that is environment friendly and sustains soil productivity. The benefits of the crop thus extend beyond the income to the farmers and the farming systems. The area occupied by the crop is 15% of the total pulse area but in some countries e.g. India and Pakistan it is the most important pulse crop and the area occupied could well be around 50% of the total pulse area (Dar, 2003).

India ranks first in the world in chickpea covering an area of 6.31 million hectare with production of 5.08 million tones (Anonymous, 2002).

Chickpea has been well recognized as a valuable source of protein particularly in the developing countries where majority of the population depends on the low priced food for meeting the dietary requirements. It's magnitude of significance is more among Indians due to their reliance on vegetarian diet besides limited buying capacity of more than 200-250 million (27%) people living below the poverty line. Like other pulses, supplementation of chickpea with cereal based diets is considered to be one of the possible solution to the problems associated with protein energy malnutrition (PEN). The daily per capita availability of 14g chickpea is a source of approximately 2.3% (56 kcal) energy and 4.7% (2.7g) protein to Indian population besides being a major source of calcium and Iron (10-12%) (Sikarwar, 2004).

The productivity of chickpea is much low as compared to cereal crops due to varied reasons. Among the factors determining the desired yield of chickpea, use of quality seeds and yield stability of genotypes over environments are most important. The study of genotype environment interaction provides useful information to identify stable genotypes over a range of environments. The growth and development of any individual plant proceed at a speed and extent pre-determined by the genetic constitution. The eventual expression of the pattern however is modified by many interlocking environmental complexes which the individual plant inhabits. Vigourous seed germinate rapidly and uniformly after planting and the emerged seedlings have the ability to grow vigorously under wide range of field conditions.

Seed vigour and vigour tests can be important for crop performance in several ways. First, vigour tests can alert the grower for a possible rapid loss between germination testing and sowing, which can arise through problems in production, handling and storage. Second, vigour tests can clearly identify lots vulnerable to less than optimum soil conditions and in crop failure at emergence. Conversely, high vigour lots can be identified for use in sub optimal conditions even without the aid of chemical seed treatments of fungicides and insecticides. Third, vigorous seed lots can be selected for special uses such as the production of synchronised emergence and consequently uniform seedlings for use in mechanized crop production systems. Finally, vigour tests can provide discerning ways of evaluating physiological seed treatments to enhance performance leading to the attractive prospects of devising methods of making bad seeds good.

Various aspects of vigour associated with yielding ability of chickpea genotypes under rainfed and irrigated conditions may be of immense importance to seed industry and in applied breeding programmes. Therefore, in the present investigation, comparative study of different chickpea genotypes were done under varying temperature conditions to select the genotype of higher vigour under laboratory condition for higher seed yield under field conditions.

Materials and Methods

The experimental material comprised of 15 bold seeded chickpea genotypes. The observations were recorded on five randomly selected competitive plants/seedlings.

Bold seeded chickpea genotypes

S.No	Genotype	S.No	Genotype	S.No	Genotype
1	RG 2001-1	6	RG 2001-7	11	RG 2001-12
2	RG 2001-2	7	RG 2001-8	12	RG 2001-13
3	RG 2001-3	8	RG 2001-9	13	H 97-49
4	RG 2001-5	9	RG 2001-10	14	Vaibhav
5	RG 2001-6	10	RG 2001-11	15	JG - 11

Physically sound seeds of the same grade were used for the experimental purpose. Each seed vigour test was carried out in three replications for each genotype separately.

Performance of five highest yielding bold seeded chickpea under different temperature conditions revealed that 25^{o} C - 30^{o} C temperature was optimum for various seed/seedling vigour tests for chickpea as compared to other temperatures, at which the testing was done.

In bold seeded chickpea

Germination

The experimental study for germination percentage at various temperature showed that the optimum temperature for germination % was 25^{o} C. The germination percentage was comparatively low as the temperature was increased to 30^{o} C and 35^{o} C.

First Count

First count for all the genotypes were found to be minimum at 10^{o} C and 15^{o} C, A sharp increase in first count was noticed at temperature 20^{o} C and 25^{o} C. A gradual decrease in first count was observed as the temperature was raised from 30^{o} C to 35^{o} C.

Speed of germination

The optimum temperature for speed of germination was found to be 25^{o} C. The increase in speed of germination was noticed as the temperature was increased from 10^{o} C to 25^{o} C. There was a decrease in speed of germination as the temperature was further increased to 30^{o} C and a sharp decrease at 35^{o} C.

Seedling growth rate

The minimum index value for seedling growth rate was observed at 10^{o} C and 15^{o} C. There was an abrupt increase in the index value as the temperature was raised to 20^{o} C. The optimum seedling growth rate was seen at 25^{o} C to 30^{o} C. There was again an abrupt decrease when the temperature was raised to 35^{o} C.

Seedling length 8^{th} day

The optimum temperature for seedling length 8^{th} day was observed at 25^{o} C - 30^{o} C. The minimum value was observed at 10^{o} C and 15^{o} C with a steep increase at 20^{o} C and again an abrupt decrease as the temperature was raised to 35^{o} C.

Seedling dry weight

The seedling dry weight was maximum at 30^{o} C. The variation in seedling dry weight was seen as the temperature raised from 10^{o} C to 25^{o} C with a decrease at 35^{o} C.

Results and Discussion

In bold seeded chickpea the optimum temperature for germination % was 25^{o} C. The germination percentage was comparatively low as the temperature was increased to 30^{o} C and 35^{o} C. First count for all the genotypes were found to be minimum at 10^{o} C and 15^{o} C, A sharp increase in first count was noticed at temperature 20^{o} C and 25^{o} C. A gradual decrease in first count was observed as the temperature was raised from 30^{o} C to 35^{o} C. The optimum temperature for speed of germination was found to be 25^{o} C. The increase in speed of germination was noticed as the temperature was increased from 10^{o} C to 25^{o} C. There was a decrease in speed of germination as the temperature was further increased to 30^{o} C and a sharp decrease at 35^{o} C. Seedling The minimum index value for seedling growth rate was observed at 10^{o} C and 15^{o} C. There was an abrupt increase in the index value as the temperature was raised to 20^{o} C. The optimum seedling growth rate was seen at 25^{o} C to 30^{o} C. There was again an abrupt decrease when the temperature was raised to 35^{o} C. The optimum temperature for seedling length 8^{th} day was observed at 25^{o} C - 30^{o} C. The minimum value was observed at 10^{o} C and 15^{o} C with a steep increase at 20^{o} C and again an abrupt decrease as the temperature was raised to 35^{o} C. The seedling dry weight was maximum at 30^{o} C. The variation in seedling dry weight was seen as the temperature rose from 10^{o} C to 25^{o} C with a decrease at 35^{o} C.

Performance of five highest yielding bold seeded chickpea under different temperature conditions revealed that 25^{o} C - 30^{o} C temperature was optimum for various seed/seedling vigour tests for chickpea as compared to other temperatures, at which the testing was done.

Studies were conducted by Singh *et al*. (1988), Sharma and Maloo (1989), Singh and Singh (1990), Singh *et al.* (1993), Katiyar *et al.* (1992), Kumar *et al.* (1996) and Patil *et al.* (1996) for yield and its components over different environments. Popalghat *et al.* (1999), Tiwari *et al.* (2000), Sood *et al.* (2001), Rao and Rao (2003) and Sohane *et al.* (2003) analyzed chickpea genotypes for yield traits over variable environments and worked out their stability for seed yield on the basis of mean performance, regression coefficient and deviation from regression

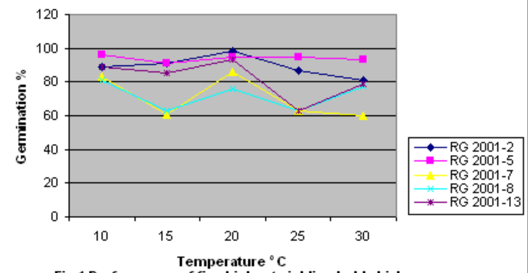

Fig.1 Performance of five highest yielding bold chickpea genotypes under different temperature conditions for germination %

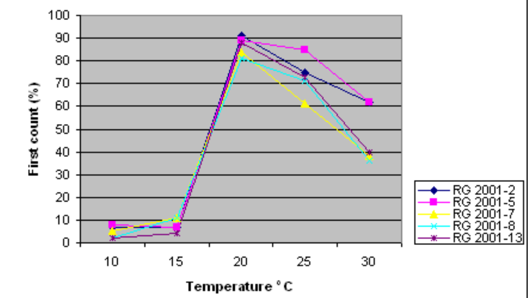

Fig.2 Performance of five highest yieldling bold seeded chickpea genotypes under different conditions for first count

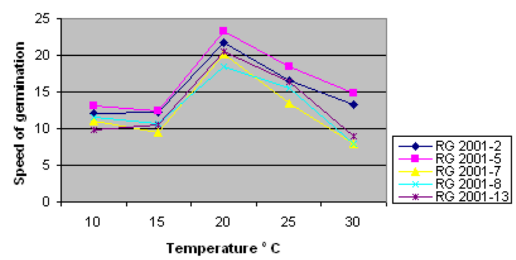

Fig. 3 Performance of five highest yielding bold seeded chickpea genotypes under different temperature conditions for speed of germination

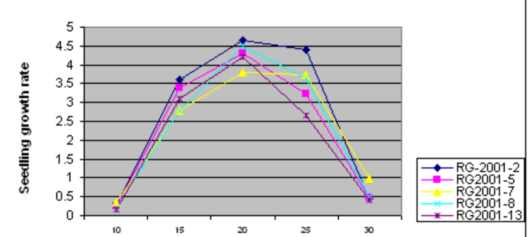

Fig. 4 Performance of five highest yielding bold seeded chickpea genotypes under different temperature conditions for seedling growth rate

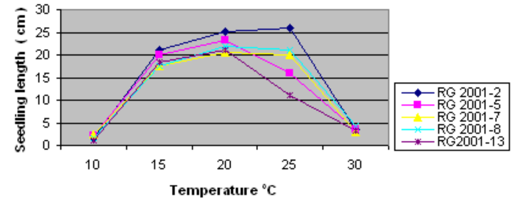

Fig. 5 Performance of five highest yielding bold seeded chickpea genotypes under different temperature condition for seedling length at 8th day

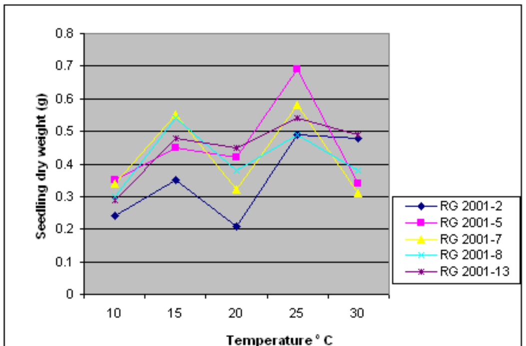

Fig. 6 Performance of five highest yielding bold seeded chickpea genotypes under different temperature conditions for seedling dry weight

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