

# Study of temperature influence on seed and seedling vigour in medium seeded chickpea for rice based cropping system

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## Abstract

The seed size of chickpea plays greater role in establishing a good chickpea crop after the rice. Small seeded chickpea varieties have greater potential as compared to the bold seeded ones under the rice based cropping system. Results of temperature influence on seed and seedling vigour in medium seeded chickpea for rice based cropping system revealed that 25°C to 30°C temperature was found optimum for various seed/seedling vigour parameters from one hand and on the other hand differential varietal performance noted for the different seed/seedling vigour parameters. Implications of these findings have been discussed in the paper.

**Keywords:** Chickpea, *Cicer arietinum* L., vigour, bold seeded, genotypes

## 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 word 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). Chickpea is traditionally grown in parts of the world covering Asia, Africa, Europe, North and South America and the bulk of it is produced and consumed in South Asian countries. In India, chickpea is a prime pulse crop of winter season i.e. *rabi* where it is cultivated as sole crop under *khari* fallows and after soybean and rice.

## MATERIALS AND METHODS

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

## Medium seeded chickpea genotypes

### Laboratory observations

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. Seed and seedling vigour of chickpea were estimated on the basis of following tests during the period from 2001 to 2003.

### In medium seeded chickpea

Germination percentage, speed of germination, first count, seedling height at 8<sup>th</sup> day, seedling growth rate and seedling dry weight were worked out separately for each chickpea genotype at 10°C, 15°C, 20°C, 25°C, 30°C and at 35°C temperature in BOD incubator. Standard procedures were adopted to conduct the tests as described under physiological tests.

### Indirect tests (Physiological tests) for seed and seedling vigour

The indirect tests are of physiological or biochemical nature related to a particular trait or property of the seed. Physiological tests of seed / seedling vigour for all the chickpea genotypes were conducted as per the following procedures.

### Germination

Growth tests are based on the principle that vigorous seeds grow at a faster rate than poor vigorous seeds even under favorable environments. Vigorous seeds rapidly germinate, metabolize and establish in the field. Therefore, any method used to determine the rapidity of growth of the seedling will give an indication of seed vigour level.

Three replicates of hundred seeds were placed between the moist towel papers and germinated at 25°C temperature according to the standard procedure (ISTA, 1985) to determine the percentage of germination on eighth day by counting the normal seedlings (appendix II).

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**First count**

The number of normal seedlings counted at 5<sup>th</sup> day after planting was considered as the first count.

**Speed of germination**

After the seeds began to germinate at 25°C in the towel paper, they were evaluated daily at approximately the same time. Normal seedlings were removed and counted daily from the tests. Procedure continued until all the seeds capable of producing a normal seedling germinated till 8<sup>th</sup> day of planting.

Germination index (G.I) was computed for each genotype separately by using

the following formula:

$$G.I = n / d$$

Where,

n = number of seedlings emerging on day 'd'

d = day after planting.

**Seedling length at 8<sup>th</sup> day**

Length of five normal seedlings grown on moist towel paper and kept at 25°C temperature was measured separately on eighth day and averaged.

**Seedlings growth rate**

Three replicates of hundred seeds were kept between moist towel papers placed at 25°C temperature in germinator for germination. Lengths of five selected seedling were measured daily from 5<sup>th</sup> day to 8<sup>th</sup> day. Seedling growth rate (index) was calculated as follows:

$$\text{Seedling growth rate (index)} = \frac{SL_1}{F_1} + \frac{(SL_1 - SL_2)}{F_1 + \dots + [SL_n - SL_{(n-1)}] / F_n}$$

SL<sub>1</sub>- mean seedling length at first count.

SL<sub>2</sub>- mean seedling length at second count.

SL<sub>1</sub>- SL<sub>2</sub> =mean increase in length in second count.

F<sub>1</sub> = days to first count.

F<sub>n</sub> = days to final count.

**Seedling dry weight**

Eight day old five seedlings of each genotype were dried at 110°C temperature for 17 hours in hot air oven. The mean weight of seedlings including cotyledons was measured in gram.

**RESULTS AND DISCUSSION**

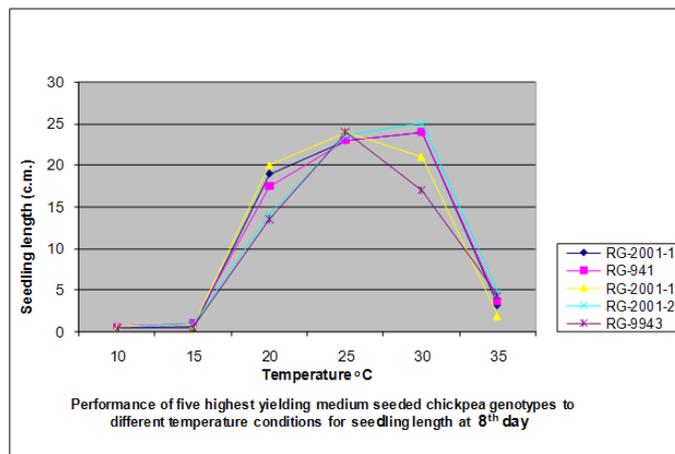
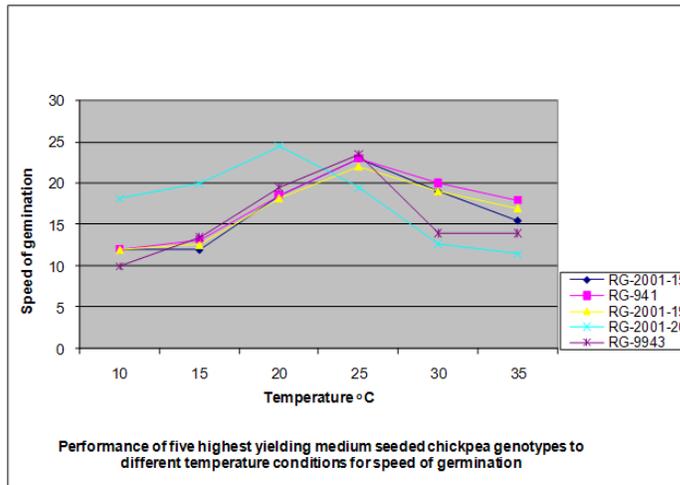
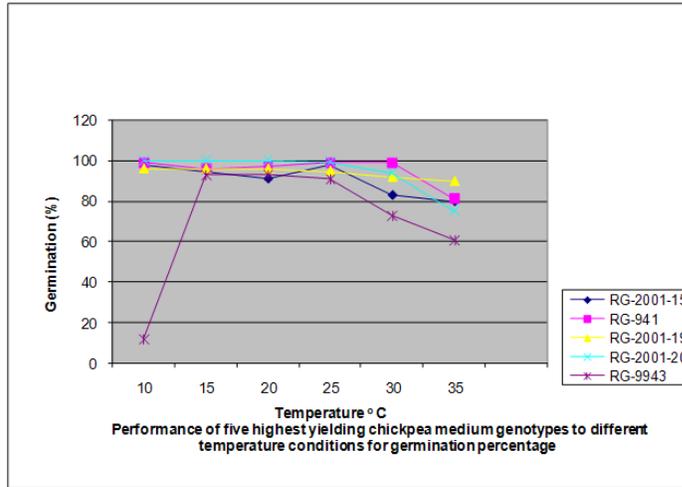
The rice based cropping system is basically stress environment for its cultivation because of changed hard soil texture after rice and is also going along with the duration of rice varieties. Chickpea after early rice grows well as compared to the chickpea grows after late maturing rice varieties because of varying temperatures and photoperiod. Under these situations chickpea behaves differently. The present investigation was undertaken to study the effect of varying temperatures on medium seeded chickpea which can fit well under the rice based cropping system.

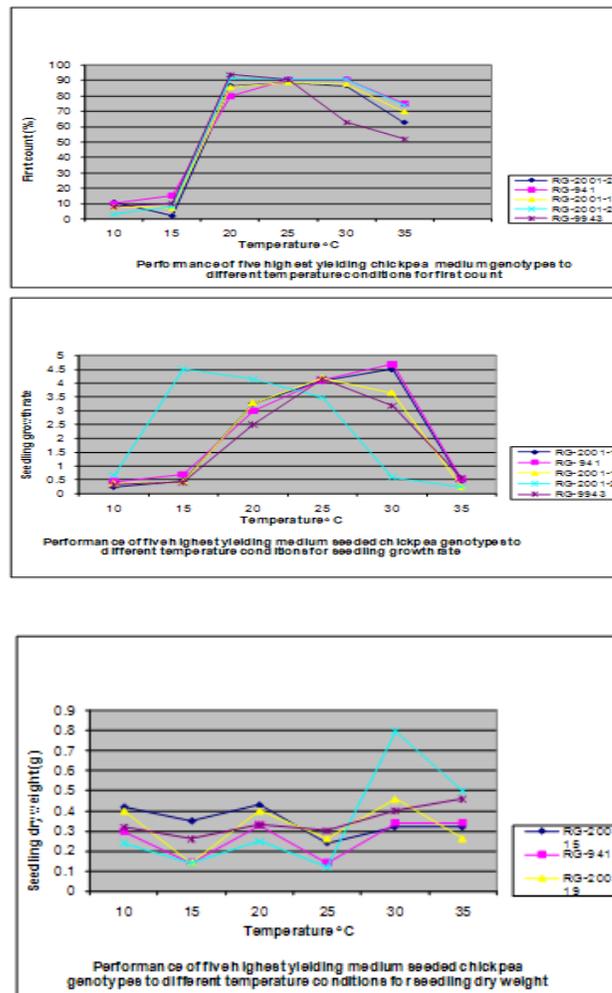
In medium seeded chickpea the optimum temperature for germination percentage was observed at 25° C with a gradual decrease as the temperature was raised from 30° C to 35° C. First count for medium seeded chickpea was observed to be minimum for 10° C and 15° C. There was a steep increase at 20° C temperature. Stable performance for first count was observed at the temperature 25° C and 30° C. A gradual decrease in performance was seen as the temperature was increased to 35° C. An increase in speed of germination was observed as the temperature was increased from 10° C to 20° C. The optimum speed of germination was observed at the temperature from 20° C - 25° C with a decrease as the temperature was further increased to 35° C. The seedling growth rate increased with the increase in temperature from 10° C to 30° C. The optimum temperature for seedling growth was observed at 30° C with a steep decrease at the temperature 35° C. An increase in seedling length at 8<sup>th</sup> day was observed as the temperature was increased from 10° C to 30° C. The optimum temperature was recorded at 25° C - 30° C. A decrease in seedling length 8<sup>th</sup> day was observed as the temperature was raised to 35° C. Variation in seedling dry weight was observed for seedling dry weight as the temperature was increased from 10° C to 25° C. The optimum temperature for seedling dry weight was recorded at 30° C.

Performance of five highest yielding medium seeded chickpea under different temperature conditions revealed that 25° C - 30° 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.

S.No	Genotype	S.No	Genotype	S.No	Genotype
1	RG 2001-14	6	RG 2001-19	11	RG 9949
2	RG 2001-15	7	RG 2001-20	12	RG 9943
3	RG 938	8	RG 9913	13	RG 9955
4	RG 941	9	RG 9920	14	RG 2001-4
5	RG 2001-18	10	RG 9903	15	JG - 74





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