Journal of Agrometeorology 12 (1): 61-63 (June 2010)

Characterization of crop growing environment of chickpea in Haryana*

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ABSTRACT

The data on area, production and productivity of chickpea crop in different districts of Haryana were collected for 27 seasons (1978-79 to 2004-2005) to study characterization of crop growing environments. The data showed that there had been drastic decrease in area and production in north and central part of the state. The southern parts of the state showed comparatively less decrease or increase in area and production. There is no trend in the productivity. By analyzing the trends of recent years, the districts of Hisar and Bhiwani had high spread and high productivity during 1993-97 periods. Sirsa fell in medium spread and high productivity zone, whereas Mahendergarh, Jind, Gurgaon and Rohtak had low spread but high productivity. In the recent pentad (1998 to 2002), only Bhiwani district had high spread and medium productivity, whereas Sirsa and Hisar recorded medium spread but high productivity. Mahendergarh, Jind and Gurgaon fell in low spread and high productivity category, whereas Rohtak falls in low spread and medium productivity zone. Models have been developed to predict chichpea yield in Karnal and Mahendergarh districts.

Key words : Characterization, chickpea, growing environments

Chickpea (*Cicer arietinum*) is the world's third most important food legume and India was placed first in production. It is high in protein and one of the earliest cultivated vegetables. It is a cool season annual crop and produces good yields in drier conditions because of their deep tap root. It has been grown in semi-arid regions of the world for hundreds of years (Kumar and Abbo, 2001). It often experience short growing seasons as a result of drought, heat, or end-of-season frost (Khanna-Chopra and Sinha, 1987). Dryland chickpea production is dependent on irregular, generally scarce, rainfall and on residual soil moisture. These conditions, coupled with increasing temperatures and seasonal water stress, cause variation in yield, which is generally low (Oweis *et al*., 2004). High temperatures during reproductive development often negatively impact pollen viability and fertilization (Hall, 2004), floral bud development (Prasad *et al*., 2002), seed filling (Boote *et al*., 2005) and seed composition (Thomas *et al*., 2003). Atmospheric temperatures are expected to increase in the future due to potential climatic changes (Cutforth, 2000). This may increase the frequency of temperature stress for annual crops including chickpea. Heavier rainfall seasons show reduced yields due to disease outbreaks and stem lodging problems from the excessive vegetative growth. Areas with lighter, well distributed rainfall patterns have produced the highest yield and quality chickpea seed.

MATERIALS AND METHODS

The data on area, production and productivity of chickpea crop in different districts of Haryana were collected from 19 districts for 27 seasons (1978-79 to 2004-2005). District has been taken as a study unit for analysing data. District-wise data on net sown area and weather parameters in the state were collected from Statistical Abstract of Haryana. The long term averages of per cent area covered by chickpea to net sown area in different districts were calculated. Correlation and regression analysis was done and multiple regressions were developed with yield and weather parameters.

RESULTS AND DISCUSSION

The data showed that there had been drastic decrease in area and production in north and central part of the state (Fig. 1). The southern parts of the state showed comparatively less decrease or increase in area and production. There is no trend in the productivity. By analyzing the trends of recent years, the districts of Hisar and Bhiwani had high spread and high productivity during 1993-97 periods. Sirsa fell in medium spread and high productivity zone, whereas Mahendergarh, Jind, Gurgaon and Rohtak had low spread but high productivity. In the recent pentad (1998 to 2002), only Bhiwani district had high spread and medium productivity, whereas Sirsa and Hisar recorded medium spread but high productivity. Mahendergarh, Jind and Gurgaon fell in low spread and high productivity category, whereas Rohtak fell in low spread and medium productivity zone.

*Papers presented at and reviewed for proceeding of national seminar on "Agrometeorology-Needs, Approaches and Linkages for Rural Development" held at CCSHAU, Hisar during 26-27 November 2009.

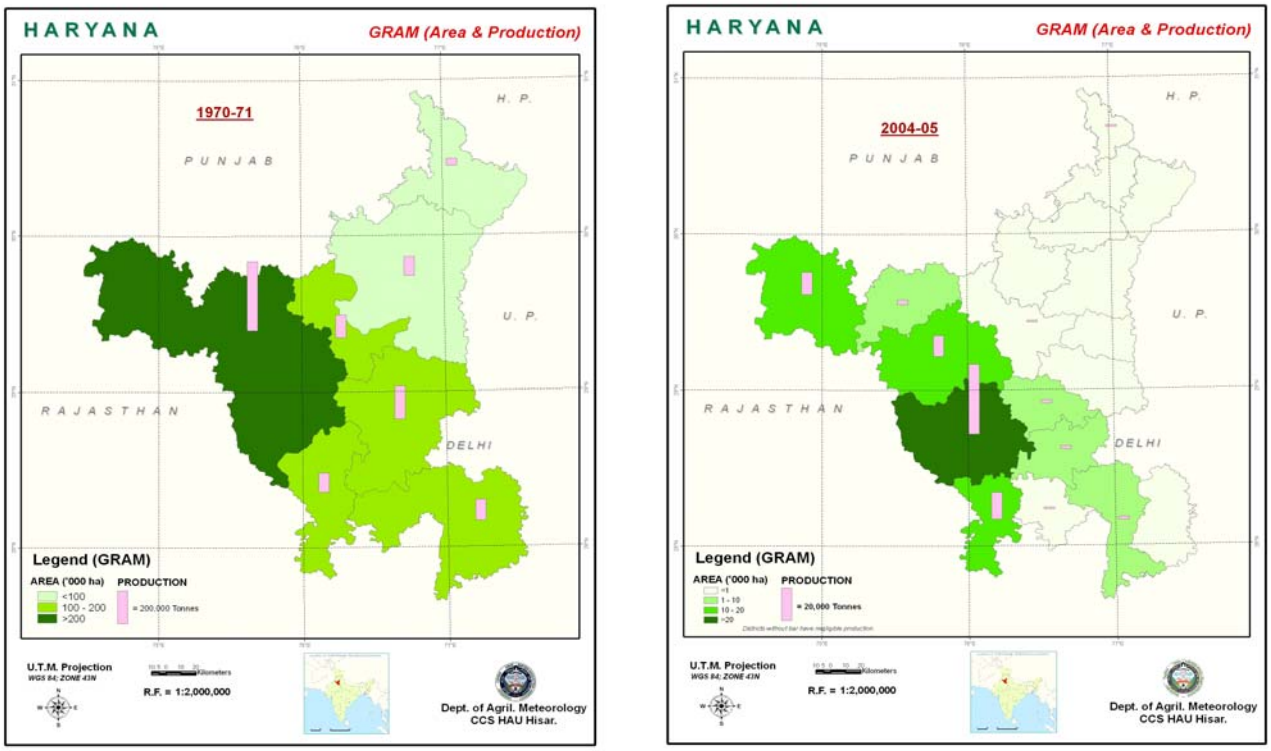

Fig. 1: Area and production of chickpea of different districts of Haryana during 1970-71 and 2004-05.

Different weather parameters for Hisar station were correlated with productivity of chickpea. The correlation matrix showed that minimum temperature and evening relative humidity of February month showed positive correlation with yield, whereas morning relative humidity and wind speed of December, rainfall of March and sunshine hours of February showed negative correlation. Productivity of chickpea was also correlated with weather parameters for Karnal and was found that temperature, relative humidity, rainfall and evaporation could explain the productivity of chickpea better than the other weather parameters (Eqn. 1). Similar results have been reported by Francisco *et al*. (2008).

$$\text{Yield}=582.4+94.6X_1-0.80X_2-2.30X_4$$

$$(R^2=0.83)\ldots\ldots\ldots\ldots(1)$$

Where, X_1=Minimum temperature of 3rd SMW, X_2=Evening relative humidity of 3rd SMW and X_4=Pan evaporation of 49th SMW.

Different weather parameters were correlated with productivity of chickpea for Mahendergarh district. The correlation matrix showed that minimum temperature during 2nd week of February, morning relative humidity during 2nd fortnight of January and sunshine hours during March showed positive correlation with yield, whereas wind speed during 3rd week of February, rainfall of March and evaporation during 1st fortnight of March showed negative correlation (Eqn. 2).

$$\text{Yield}=-470.85-9.37X_1+17.58X_2+37.35X_3-5.21X_4+9.84X_5$$

$$(R^2=0.79)\ldots(2)$$

Where, X_1=Minimum temperature of 8th SMW, X_2=Morning relative humidity of 4th SMW, X_3=Sunshine hours of 45th SMW, X_4=Rainfall of 45th SMW and X_5=Evening relative humidity of 46th SMW.

These models can be used to predict chickpea yield in Karnal and Mahendergarh districts of Haryana.

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