Summer Mung Crop Production in the Context of Climate Change: An Appraisal

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ABSTRACT

India is highly vulnerable to climate change and its economy is highly dependent on climate sensitive sectors like agriculture. Temperature increases above 2.5°C will generally have negative overall effects on world agriculture. Amongst the pulses, Mungbean is most important Kharif as well as summer crop. The cultivation of summer mung is more sensitive to increase in temperature because in the month of May and June when temperature go above 46 ºC in Western Indo-Gangetic plains the flower drop also increases and this leads to failure of crop. The paper includes the observation on vegetative and reproductive performance of crop and agronomic practices of summer mung technology in relation to weather changes at Agra.

Key Words: *Climate change; Reproductive performance; Summer mung; Temperature; Yield;*

Mungbean is an important pulse crop. Historically, India has been the largest global producer and consumer of mungbean. It has wider adaptability and low input requirements and the ability to fix the nitrogen in symbiotic association with rhizobia (58-109 kg/ha), which not only enables it to meet its own nitrogen requirement but also benefits the succeeding crops (*Singh, et al., 2011*). Mungbean is a short duration crop that can be grown over a range of environments. It is grown extensively in India under varying soil types and climatic conditions. India alone accounts for about 65% of the world's acreage and 54% of the world production of this crop. Despite holding such great promise, mungbean is often grown in marginal lands with limited inputs making it prone to a number of abiotic stresses causing tremendous yield loss. For the adaptation of a crop to new environment, tolerance to abiotic stress is more important than the biotic stress. Terminal heat and drought stress may lead to considerable flower drop and thus to reduced pod set (*Singh, et al., 2011*).

The optimum average temperature for potential yield of mungbean lies between 28-30ºC It is also grown in summer when the temperature and light irradiance fluctuate frequently. In some of mungbean growing areas of the tropics, the early summer is characterized by high temperature (often exceed 40ºC) and cloudy sky, while the late summer has high temperature and bright sunshine. Because of tropical monsoon the irradiance shows regular fluctuation during the same day; it may drop from full sunshine to a minimum level. The day temperature is normally high throughout the long summer but shows fluctuation (*Poehlman, 1991*).

Climate change and agriculture are interrelated, both of which take place on global scale. The effect of climate on agriculture is related to variability in local weather rather than in global climate pattern. The earth's average temperature has increased by 1 degree F in just over the last century. Consequently, agronomists consider any assessment has to be individually considered at each local area. Local or regional specific studies assume greater significance to understand the impact of climate change on agriculture and also for developing mitigation strategies (*Kalra et al., 2008*).

METHODOLOGY

The present study was conducted in Dayalbagh area of Agra district (Uttar Pradesh) during Rabi seasons for three successive years (2009-2011). The cultivar Pusa Vikas and Pusa Vishal was selected for sowing. The variety was procured from IARI, New Delhi. The seeds were treated with synthetic as well as Biofertilizers (*Gaur 2010*). The cultivar was evaluated for vegetative and reproductive performance at different days after sowing (DAS). In the present study of

Dayalbagh region at Agra (UP) the sowing of summer mung was done at two different dates in two different years. In 2009 the sowing was done on 21 March while in 2011 the sowing was done on 28 Febuary. The various vegetative and reproductive parameters were observed from date sowing to harvesting of crop. The vegetative parameters included Plant population density, height of the plant, primary branches leaflet/plant, nodules/plant etc and reproductive parameters included flowering phenology, floral density, pods/plant, seeds/ pod and pod drop. The weather data for the above period is procured from Indian Metrological Department for the analysis of present study of Mungbean crop production. (*Sulochana Gadgil and Seshagiri Rao, 2000*).

RESULTS AND DISCUSSION

Mungbean is grown in Kharif (Monsoon), winter and spring/summer seasons in different agro-ecological regions. On account of their ability to reduce protein malnutrition, improve soil health and conserve natural resources, have special role in sustainable agriculture. The short duration mungbean offer the most viable option for diversification both in intensive agriculture and rain-fed area beside introduction in new niches. India has the distinction of being the top producer of this pulse crop in the world. (*Masood Ali and Shiv Kumar, 2006*).

Cultivation of Summer Mung is now becoming more and more popular with farmers in northern India as their practices enables them to use the land and the water resources which otherwise would have remained unutilized during this period. Moreover, summer mung can be fitted very well in different cropping systems (*Rao et al., 2009*).

Optimum time for sowing of Mungbean vary from variety to variety and season to season due to variation in agro-ecological conditions. Therefore, there must be specific sowing dates in summer season to obtain maximum yield. Delayed sowing after March, early sowing before February, reduce the yield of Summer Mungbean. February may be consider optimum time for sowing of summer Mungbean and late planting after March may result in damage during maturity period (*Dharmalingam and Basu 1993*).

The study of vegetative and reproductive parameters shows that that plant population density, flowers/plant and pods/plant were more in year 2011 as compare to 2009. However, the observations of pod traits shows that pod length and pod circumference and seeds/pod were less in 2011as compared to previous year. There is 280 kg/ha yield difference in both the years. This yield reduction may be due to combination or one of the factor i.e. flower drop or pod drop. During 2010 the farmers did not opt for summer mung technology due to increase in maximum and minimum temperatures than previous year. (Table 1 and 2).

Average Temperature Changes Pattern : The data given in Table 3 reveal that average maximum temperature for the year 2007-2011(August) is 32.8ºC whereas average minimum temperature during the same

Table 1. Vegetative Parameters of Mungbean crop in the three different years

S No	Parameters	Years of the sowing		
		2009	2010	2011
1.	Plant Population density	29Plants/m^2	The farmers did not opt for summer mung technology due to the high temperature and low water availability	32Plants/m^2
2.	Plant Height	15.82 cm		20.56 cm
3.	Primary Branches	3.42		6.48
4.	Leaflets/Plant	15.17		25.24
5.	Nodules/Plant	No nodule		6.5

Table 2. Reproductive Parameters of Mungbean crop in the three different years

S. No	Parameters	Years of the sowing		
		2009	2010	2011
1	Floral density	12.65Flowers/Plant	The farmers did not opt for summer mung technology due to the high temperature and low water availability	12 Flowers/Plant
2	Pods/Plant	11.27		10.0
3	Seeds/Pod	8.32		6.0
4	Pod length	7.11		6.48
5	Pod Circumference	1.78		1.57
6	100 seed weight	4.0 gm		4.2 gm
7	Seed Yield	1080 kg/ha		800 kg/ha

period was 21.2ºC. However an increase of maximum temperature by 1 ºC and minimum temperature by 2 ºC was recorded for the year 2010. This increase both in maximum and minimum temperature may be responsible for flower drop in Summer mung that ultimately resulted in an average yield loss of about 280kg/ha yield loss. It was further computed that with every 0.1ºC increase in maximum and minimum temperature the reduction in yield was 28 kg/ha and 8.2kg/ha respectively. (Sinha and Swaminathan 1991) (Table 4).

Table 3. Change pattern of maximum and minimum temperature in Agra region over the years (2009-2011)

S.No.	Year	Average Maximum Temp(°C)	Average Minimum Temp(°C)	Average maximum temp for base year (2007-2008)	Average minimum temp for base year (2007-2008)	Average deviation of maximum temp from the base year	Average deviation of minimum temp from the base year
1.	2007	32.4	18.5	–	–	–	–
2.	2008	32.0	19.9	–	–	–	–
3.	2009	32.9	22.3	32.2	19.2	+0.7	+3.1
4.	2010	33.7	22.7	–	–	+1.5	+3.5
5.	2011	33.0	22.9	–	–	+0.8	+3.7
Averall Average		32.8	21.2	–	–	+1.0	+3.4

Table 4. Consequences of changed weather parameters on the yield of Summer Mung crop

S.No.	Year	Increase in temperature (°C)		Actual yield (kg/ha)	Declined yield (kg/ha) of
		Max. temp	Min. temp	of Lentil crop	Lentil crop in two years
1.	2009	+0.7	+3.1	1080	–
2.	2010	+1.5	+3.5	–	–
3.	2011	+0.8	+3.7	800	-280
	Average	+1.0	+3.4	–	280
Change in yield reduction with every 0.1ºC increase in max. and min. temperature				Max. Temp -28 kg/ha	Min. Temp -8.2kg/ha

CONCLUSION

The above study shows the impacts of changing climatic conditions on the productivity of Mungbean crop at Agra. As the climate shifts, the synchrony between climate and crop commonly disrupted. Adaptations technologies are an attempt to restore the synchrony or establish new synchronization between climate and Mungbean crop. The developing new agro-technologies will require prediction of future climate conditions that are likely to occur and development of new cultivar will require for the identification of crop traits that will allow the crop to respond well to future climate. The alternate management practices must be put in place urgently to achieve food and nutrition security.

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