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Agro ecological zoning and estimation of potential yield of potato in plateau regions of India

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ABSTRACT

The potential yield estimator model developed by Central Potato Research Institute, Shimla was run for four different planting dates under rainfed situations in plateau regions of India since the potato crop is grown under rainfed conditions during *kharif* season so as to estimate the yield potential and to find out the optimum time of planting for each location. The analysis showed that the latitude of the region greatly influenced the length of growing period, start of planting season and also the yield. The simulated yield ranged from <100, to >400 q ha^{-1}. The suitable locations for *kharif* potato cultivation along with potential yields are listed for plateau region of India.

Key words: Agroecological zones, kharif potato, potential yield, temporal diversification

Potato, being a temperate crop, has been adopted well for cultivation under sub tropical conditions. In India, it is grown in almost all the states and under very diverse conditions. Nearly 80% of potatoes are grown in vast Indo-Gangetic plains of north India during short winter days from October to March. About 8% area under potato cultivation lies in the hills where the crop is grown during long summer days of April to October. Plateau regions of south-eastern, central and peninsular India, constitute about 7% area in the warmer plateau region where potatoes are grown as a rainfed k*harif* crop during the rainy season (July to October) or as irrigated *rabi* crop during winter (November to March). There are about eleven potato growing zones in India and out of them the plateau region covers vast areas of central and peninsular India (Singh *et al.*, 2008).

This zone consists of parts of Gujarat, Maharashtra, Madhya Pradesh, Karnataka and Orissa. Red sandy or fine textured block cotton soils characterize this area. The plateau region is characterized by poor sunshine, high minimum temperature and erratic rainfall during the season. All these factors limit the cultivation of this crop as they influence the length of growing season greatly (Singh and Lal, 2010). It is well known that the yield potential of a crop is determined by the availability of length of growing period and temperature (Ensign, 1935; Singh *et al.*, 2005)

So, by exploiting the suitable locations for growing *kharif* season potato, it would be possible to improve the potato production to a considerable extent in the country. Hence, an attempt was made in this present study, to characterize the potato growing environments and for estimating the potential yield for delineation of suitable locations and for knowing the yield gaps to extend the potato cultivation to non-traditional areas and seasons.

MATERIALS AND METHODS

The plateau areas in India have been reported to have altitudes between 300-1300 m above mean sea level and these were delineated from 90 m Shuttle Radar Topography Mission data available for free download. From the list of those locations, the major locations were selected and then for those locations the average weather data sets (for 10 years) were developed from published database of India Meteorological Department. The weather data which consisted of temperature (minimum and maximum), relative humidity, rainfall, rainy days and sunshine hours was estimated on daily basis by averaging the available data. With the help of weather data, the suitable locations were identified by taking the criterion of length of growing season. Length of growing season was estimated based on the temperature regime i.e. minimum temperature < 20^0 C and maximum temperature < 35^0 C. The meteorological data sets were analysed using thermal based rule set for identifying the start and end date, total duration of growing period available during *kharif* season at different locations by extracting the period with >70 days of growing period

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Table 1 : Length of growing period and its suitability for *kharif* season potato in different locations

Location	Altitude (m above m.s.l.)	Length of growing season (days) 1st June	15th June	1st July	15th July	Potential yield (q ha^{-1})
AP						
Mahbubnagar	505	33 (X)	46(X)	31(X)	67(X)	<100
Hyderabad (A)	545	32(X)	50(X)	34(X)	32(X)	<100
Arogyavaram	701	34(X)	32(X)	**71(√)**	**66(√)**	**200-300**
Karnataka						
Shimoga	571	73(√)	73(√)	77(√)	73(√)	300-400
Gadag	650	77(√)	72(√)	75(√)	75(√)	300-400
Bidar	664	76(√)	72(√)	81(√)	77(√)	300-400
Chitradurga	733	73(√)	74(√)	79(√)	76(√)	300-400
Belgaum Samra(A)	747	75(√)	76(√)	75(√)	77(√)	300-400
Belgaum	753	37(√)	37(√)	32(X)	68(√)	<100
Mysore	767	76(√)	76(√)	76(√)	76(√)	300-400
Balehonnur	885	81(√)	82(√)	81(√)	81(√)	>400
Bangalore (A)	897	75(√)	77(√)	71(√)	77(√)	300-400
Bangalore	921	77(√)	75(√)	76(√)	75(√)	300-400
Hassan	960	76(√)	79(√)	77(√)	86(√)	>400
Medikeri (Mercara)	1152	49(X)	41(X)	38(X)	37(X)	<100
Maharashtra						
Beed(Bir)	519	36(X)	36(X)	33(X)	35(X)	<100
Jeur	521	35(X)	37(X)	33(X)	76(√)	200-300
Sangli	549	31(X)	75(√)	75(√)	74(√)	300-400
Baramati	551	38(X)	37(X)	47(X)	33(X)	<100
Miraj	554	75(√)	76(√)	73(√)	77(√)	200-300
Pune	559	68(√)	70(√)	76(√)	76(√)	>400
Kolhapur	570	38(X)	31(X)	73(√)	74(√)	200-300
Aurangabad	581	34(X)	53(X)	37(X)	31(X)	<100
Nasik	598	46(X)	32(X)	76(√)	73(√)	200-300
Ozar	608	34(X)	77(√)	71(√)	74(√)	300-400
Buldana	650	34(X)	74(√)	79(√)	78(√)	200-300
Ahmednagar	657	77(√)	73(√)	74(√)	76(√)	20-300
Mahabaleshwar	1382	103(√)	103(√)	101(√)	94(√)	200-300
MP						
Bhopal	523	36(X)	33(X)	25(X)	11(X)	<100
Sagar	551	35(X)	36(X)	52(X)	38(X)	<100
Jagdalpur	553	34(X)	80(√)	75(√)	72(√)	200-300
Indore	567	38(X)	33(X)	32(X)	72(√)	200-300
Ginabahar	579	45(X)	38(X)	71(√)	70(√)	100-200
Seoni	619	34(X)	31(X)	66(X)	74(√)	100-200
Chhindwara	685	35(X)	43(X)	31(X)	32(X)	<100
Jashpurnagar	779	34(X)	45(X)	37(X)	78(√)	100-200
Panchmarhi	1075	79(√)	75(√)	75(√)	77(√)	200-300
Rajasthan						
Udaipur (Dabok)(A)	514	37(X)	37(X)	37(X)	32(X)	<100
Udaipur	582	40(X)	36(X)	72(√)	75(√)	200-300
Jhadol	605	48(X)	34(X)	39(X)	52(X)	<100

x = Not suitable √ = Suitable

continuously with temperature thresholds. This work was carried out during the year 2011 and 2012.

Potato Potential Yield Estimator (CPRI, 2011), which estimates the potential potato yield based on the FAO Agroecological Zones model for any location was used to estimate the potential yields for these selected locations. The input requirements for this tool are daily weather data, geographical co-ordinates, start and end of the growing season. This tool is complimentary to the PPGSE (Plausible Potato Growing Season Estimator) because once the growing seasons are identified; the user needs to know the expected yield of the different growing seasons.

The potential yield estimator model was run for four different planting dates (1st June, 15th June, 1st July and 15th July) using average meteorological data of ten years (2000 to 2010), to estimate the yield potential and to find out the optimum time of planting for each location. The length of growing season was estimated for each location based on the climatic requirements of the crop and this was used as the basis for delineation of suitable locations. The yield potential of each location is estimated under four different dates and from the data the locations with high yield potential and the locations with low yield potential were also identified. These apart, the areas not suitable for *kharif* potato cultivation were also identified as the length of growing season in these locations being not enough (<70 days) for potato crop to complete its life cycle.

RESULTS AND DISCUSSION

Identification of kharif potato locations in plateau region

Results indicated that in Andhra Pradesh, *kharif* potato can be grown in Arogyavaram by planting it in 1st to 15th of July as it could give around 66 to 71 days of long growing period. In Karnataka, out of 12 locations screened, except two i.e., Belgaum and Medikeri all the other locations are suitable for growing potato in *kharif* season and planting can be taken up from 1st of June to 15th of July in all these locations. In Maharashtra, out of 13 locations analysed, 10 were found suitable for growing *kharif* season potato if planted on 15th of July and 9 were suitable with 1st of July planting. A wider window (1st of June to 15th of July) for planting of *kharif* season potato is available in Miraj, Pune, Ahmednagar and Mahabaleshwar. In Madhya Pradesh, Panchamarhi is suitable for growing *kharif* season potato right from 1st of June to 15th of July and about five more places (Jagdalpur, Indore, Ginabahar, Seoni and Jashpurnagar) are suitable for 15th July planting. In Rajasthan, July planting is suitable for Udaipur alone.

Amongst the locations screened, 11 were not suitable for *kharif* potato cultivation while 21 locations were suitable for growing *kharif* potato (Table 1).

Estimation of potential yield

The locations for which potential yield was estimated were identified under <100, 100 – 200, 200 – 300, 300 – 400 and >400 q ha^{-1} categories. Amongst the locations, Balehonnur and Hassan in Karnataka and Pune in Maharashtra, were expected to have highest yield potential. At most of the locations the potential yield ranged between 200 to 400 q ha^{-1}.

CONCLUSION

Out of the forty locations under screening in five different states, 11 were found totally unsuitable and 15 were found highly suitable. Remaining were found suitable under particular planting dates. In Karnataka, most of the locations were found suitable for *kharif* potato crop. In Maharshtra, 10 out of 13 were found suitable in different planting dates. This information will be highly useful for planning *kharif* potato crop in different states with suitable planting time.

REFERENCES

CPRI News Letter, July (2011). Potential Yield Estimator. CPRI develops three new decision support tools. Pp: 2

FAOSTAT http://faostat.fao.org/ Retrieved on 01.07.2013

Ensign M R. (1935). Factors influencing the growth and yield of potatoes in Florida. P*lant Physiol.* 10 (3): 465-482.

Singh JP, Govindakrishnan PM, Lal SS and Aggarwal PK. (2005). Increasing the efficiency of agronomy experiments in potato using INFOCROP-POTATO model. *Pot. Res.*, 48: 131-152.

Singh JP, Dua VK, Lal SS and Pandey SK. (2008). Agro-economic analysis of potato based cropping systems. *Indian J. Fert.*, 4(5):31-33, 35-39.

Singh JP and Lal SS (2010). Climate change and potato production in India. ISPRS Archives XXXVIII-8/W3 Workshop Proceedings: Impact of Climate Change on Agriculture. 115-117.

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