The Andhra Agric. J 64 (2): 317-318, 2017

Climate Change- Jowar Yield Prediction model for Bapatla Coastal Agro-Ecosystem

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ABSTRACT

One component of mainstreaming of adaptation of jowar crop to climate change in Bapatla coastal agro-ecosystem is the development of an weather based adaptation strategy for the crop. Therefore, a vulnerability assessment study and an assessment of the impacts of climate change on jowar was studied. The basic knowledge, methodologies and tools required for the purpose were taken from DSSAT/CROPGROW/EPSIM. The yield and production of the jowar crop from 1991 to 2015 for both *Kharif* and *Rabi* were used. A combination of biometrical observations and weather variables of crop grown during Kharif 2015 were used to test the validity of the both simulation and regression models. The selected step down regression model develop using rainfall alone has has given R- value 0.91. From the simulation studies it was found that the contribution of climate change and variability on the yield of jowar crop is about 45 per cent during the next 50 years in the Bapatla agro-ecosystem. Interestingly, on the basis of a comparison of rainfall alone it was found that jowar crop in Bapatla agro-ecosystem is rather susceptible to excessive rain during the vegetative period(rainfall during the 30 days of vegetative period for both kharif and rabi from 10 th day of sowing or 6 th day after emergence). However, the authors strongly suggest for continued and sustained research for further refined results on the long run, the need for climate change impact studies on agricultural crops using other weather variables.

Key words: *Climate change, Jowar yield, Weather health indices.*

Crop yield forecasting is one of the most important components which is crucial for the sound planning and policy making in the state of Andhra Pradesh in general and Guntur district in particular. The traditional approach of crop yield and production estimation involves a complete enumeration for estimating crop acerage and sample surveys based on crop cutting experiments. The crop acerage and corresponding yield estimate data are used to obtain production estimates. This is a laborious and time consuming process. However, this procedure is practically and at ground level not useful for taking various policy decisions related to price fixing, marketing , export or import, distribution to consumers etc (Ghosh et al 2014). Therefore, an attempt is made to provide an objective assessment of jowar crop at pre-harvest stages with spatial details of Guntur district for in-season crop yield forecast through adoption of both regression and crop yield simulation models.

MATERIALS AND METHODS

The basic knowledge, methodologies and tools required for the purpose were taken from DSSAT, CROPGROW, and EPSIM. The variations in jowar yield that can be attributed to weather vis-a- vis climate change were also tested using the best possible statistical models as well(Zaman et. Al 1982). The yield and production of the jowar crop from 1991 to 2015 for both *Kharif* and *Rabi* were used. The weather variables such as minimum, maximum and mean temperature, the derived weather indices such as GDD, HTU, PTU and rainfall from 1979 to 2015 for climate change and from 1991 to 2015 for biometric observations were used (Murthy2015 and 2016). A combination of biometrical observations and weather variables of crop grown during in farmers fields were used to test the validity of the both simulation and regression models. By step down regression approach only rainfall related yield model was developed. This was verified with viz., DSSAT, CROPGROW, and EPSIM. A combination of biometrical observations and weather variables of crop grown during Kharif 2015 were used to test the validity of the both simulation and regression models.

RESULTS AND DISCUSSION

Jowar crop is susceptible to excessive rain during the vegetative stage (Vaidyanathan 1980). If excessive rains occur during the vegetative stage of either kharif (SW monsoon rains) or rabi (

NE monsoon and cyclonic rains) the yields are drastically reduced Vaidyanathan, 1980). The average rain fall in Guntur district is 810 mm. The SW and NE monsoons and cyclones bring rains. The SW monsoon accounts for 60% and NE monsoon 27% and cyclonic and pre-monsoon rains 13 %. October is the rainiest month. January is the low rainy month. The variation in the rainfall in the district from year to year is appreciable. The spatial variability of annual rainfall (CV %) is about 30%. The amount of rainfall in SW monsoon is 500-750 mm with variability of 30-40%. During NE monsoon it is 200-300 m and variability is as high as 50 to 70 %. In the 36 year period from 1979 to 2015 the highest annual rainfall amounting to 154 % of the normal was received. The lowest rainfall 64% of the normal. Two or three years of consecutive high or low of normal rainfall is common in the district. In addition, on an average there are 49 rainy days (days with rainfall of 2.5 mm or more) in a year. 78% of these rainy days occur from June to September during which kharif jowar crop passes through the vegetative stage. Again 22% occur during October- November when the rabi jowar is in its active vegetative stage. With this background a yield prediction model based on only one weather element "rainfall" is developed . The other weather elements and derived parameters viz., GDD,HTU, PTU etc., were used in models . The regression model developed is as follows:

Grain yield (Pooled for kharif and rabi in Kg per hectare)= 901.01 + 18.20 X RFv

(Where, RFv= Rainfall during the 30 days of vegetative period for both kharif and rabi from 10 th day of sowing or 6 th day after emergence).

One component of mainstreaming of adaptation of jowar crop to climate change in Bapatla coastal agro-ecosystem is the development of a weather based adaptation strategy for the crop (Siva kumar, 2017). Therefore, a vulnerability assessment study and an assessment of the impacts of climate change on jowar was studied as detailed above. A combination of biometrical observations and weather variables of crop grown during in farmers fields 2015 were used to test the validity of the both simulation and regression models. The above selected step down regression model has given R- value 0.91. From the simulation studies it was found that the contribution of climate change and variability on the yield of jowar crop is about 45 per cent during the next 50 years in the Bapatla agro-ecosystem. the agriculture sector.One component of the mainstreaming of Adaptation to climate change adaptation strategy for the jowar crop in Bapatla agro-ecosystem is study of vulnerability assessment and assessment of the impacts of climate change on jowar crop. Therefore, basic knowledge, methodologies and tools required to carry out climate change impact assessments on the jowar crop are required. Top of Form Conclusion: On the basis of a comparison of rainfall alone during the growing seasons from 1991 to 2015 it was found that jowar crop in Bapatla agro-ecosystem is rather susceptible to excessive rain during the vegetative period i.e., the rainfall during the 30 days of vegetative period for both kharif and rabi from 10 th day of sowing or 6 th day after emergence. However, the authors strongly suggest for continued and sustained research for further refined results on the long run, the need for climate change impact studies on agricultural crops using other weather variables.

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(Received on 27.12.2016 and revised on 31.1.2017)