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Assessment of Climatic Water Balance for Kalamb Taluka for Crop Planning

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Abstract:- An agro climatic study was conducted at Tal. Kalamb Dist. Yavatmal Vidharvha region of Maharashtra using database of 20 years (1998-2017) to assess the climatic water balance. The analysis of water balance components done on weekly basis. The average annual rainfall for Akola estimated as 796.44 mm. more than 30 mm rainfall 24 SMW to 38 SMW, more than 40 mm rainfall week during 28 SMW to 36 SMW and 50 mm rainfall occurrence in 29 SMW to 32 SMW. The highest PET was observed in 20 SMW weeks that is 54.11 mm and the lowest was observed in 1 SMW week i.e. 24.2 mm. The weekly total AET was recorded as 580.88 mm for period 1998 to 2017. The highest ATE was 28.4 mm during 30 SMW weeks and lowest was 0.05 mm during 21 SMW. The annual deficit determined as 1284.29 mm. SMI > 0.5 was found to occur during the period from 27 SMW to 40 SMW. The annual effective rainfall was found 577.42 mm during period of 1998 to 2017. The highest effective period of rainfall found in June to July month and weak at 22 to 42 SMW.

Under average rainfall condition, the period during which AET was greater than 25% of PET prevailed from 24 to 46 SMW, whereas the period during which AET more than 50% of PET existed during the period from 24 to 42 SMW

Keywords: *Rainfall, Actual Evapotranspiration, Potential Evapotranspiration, Water Surplus, Water Deficit.*

I. INTRODUTION

Water is very essential resource for mankind. The availability of pure water is less in the region and one of the factors dependent is rainfall which is unevenly distributed. In semi-arid region rainfall is less and unpredictable; hence demands of water for drinking and irrigation becomes critical. For planning and managing of available resources at watershed level, water regime of area need to be studied by using water balance approach.

In semi-arid regions, water resources are limited and thereby the available groundwater for irrigation and other water uses are severely constrained. Water demand for agriculture arid to humid landscape. However, there is always need for optimum use and planning of water resources. At global level climate changes day by day. It may influence the air temperature, rainfall patterns impacting the availability of water, along with the danger of increasing occurrences of droughts and production of crop.

The Central Maharashtra zone belongs to semi-arid climatic regions, it characterized by limited water resources due to expanding urban, industrial and agricultural water demands. In semi-arid regions, the actual evapotranspiration (AET) represents a key role of the hydrological cycle. AET may account for more than 90 % of the precipitation (Pilgrim *et. al.*, 1988; Huxman *et al.*, 2005). The state experienced massive agricultural losses due to water scarcity in recent years.

The water balance studies provide an indirect evaluation of an unknown water balance component from the known components. By considering the importance of water balance, the research work involving evaluation of water balance for Tal. Kalamb Dist. Yavatmal. Hence, an attempt has been made to assess the climatic water balance for evaluation of effective crop management strategy with the objective to compute the water balance components.

II. MATERIALS AND METHODS

- *Study Area*

The study was conducted at Taluka Kalamb Dist. Yavatmal Vidharbha region of Maharashtra. The district lies between 19°26’ and 20°42’ North latitude and 77°18’ and 79°9’ East longitude.

- *Data Collection*

The daily rainfall data for sixteen talukas of Yavatmal district was collected from www.mahaagri.gov.in. For Kalamb taluka daily rainfall data for the year 1999 was unavailable. Maximum and minimum temperature data for Yavatmal taluka was collected from All India Coordinated Research Projects on Agrometeorology, Dr. PDKV Akola for period of 20 years *i.e.*1998 to 2017. It is used for the calculation of minimum and maximum temperature by using the phenomenon of environmental lapse rate.

III. METHODOLOGY

Year-wise weekly water balance computation was carried out by using weekly total rainfall, normal total PET and AWHC following the procedure given by (1985) model (Article 3.3.3) by using ‘Weather cock’ software. Output components of water balance method were soil moisture storage (SMS), actual evapotranspiration (AET) and water surplus, water deficit, soil moisture index (SMI). The derived parameters estimated from the water balance parameters were index of moisture adequacy index (I_{ma}), which is the ratio between AET and PET and soil moisture index (SMI) which is the ratio between SMS and AWHC. The water balance method considered that when rainfall was greater than PET, AET was taken as equal to PET and when rainfall was below the PET; the AET was calculated as the sum of rainfall and change in soil moisture storage between two successive

weeks. The surplus water was determined in the present study. The effective rainfall was calculated by subtracting water surplus from rainfall (Chang, 1968).

IV. RESULTS AND DISCUSSION

A. *Weekly water balance analysis*

The results on average rainfall, PET, AET, water surplus, water deficit and soil moisture index (SMI) for period of 1998-2017, presented in Fig. 1 revealed that highest average rainfall was observed in 32 SMW (70.32 mm) whereas lowest was observed in 43 SMW (2.32 mm). Figure 1 revealed that average rainfall was 10 mm during 23 SMW to 41 SMW, more than 30 mm rainfall 24 SMW to 38 SMW, more than 40 mm rainfall week during 28 SMW to 36 SMW except 33 to 35 SMW and 50 mm rainfall occurrence in 27 SMW to 32 SMW except 28 SMW. The highest weekly rainfall was 70.32 mm in 32 SMW followed by 65.7 mm in 29 SMW. The week where rainfall 40 mm is 25 SMW to 32 SMW for consecutive period, could be identified as the growing period of different *Kharif* and *rabi* crop in Tal. Kalamb Dist. Yavatmal.

The PET was greater than 40 mm during 12 SMW to 24 SMW, whereas the PET was greater than 50 mm from 17 SMW to 22 SMW. PET was below 30 mm found in 44 SMW to 6 SMW. PET was not less than 20 mm during any week. The highest PET was observed in 20 SMW weeks that is 52.48 mm and the lowest was observed in 1 SMW week i.e. 23.64 mm. The weekly total AET was recorded as 581.51 mm for period 1998 to 2017. The highest ATE was 29.99 mm during 26 SMW weeks and lowest was 0.06 mm during 20 SMW.

Water surplus which includes runoff and deep drainage was found to prevail from 26 SMW to 41 SMW it shows that PET value goes on decreasing throughout the corresponding SMW. This information provides scope for identification of suitable crop varieties to match with the period of water surplus. The highest water surplus was recorded as 36.87 mm during 32 SMW. The total annual surplus was computed as 223.55 mm during 24 SMW to 41 SMW as against the total water deficit 129.71 mm during the corresponding period. However annual deficit determined as 1228.78 mm.

The 50% of AWHC value prevailed during the period from 28 SMW to 41 SMW, it indicating that under average rainfall condition, crops growing his period during would be able to produce at potential level similar variation was also observed in soil moisture index, where SMI > 0.5 was found to occur during the period from 28 SMW to 41 SMW. The annual effective rainfall was found 576.62 mm during period of 1998 to 2017. The highest effective period of rainfall found in during 23 to 47 SMW.

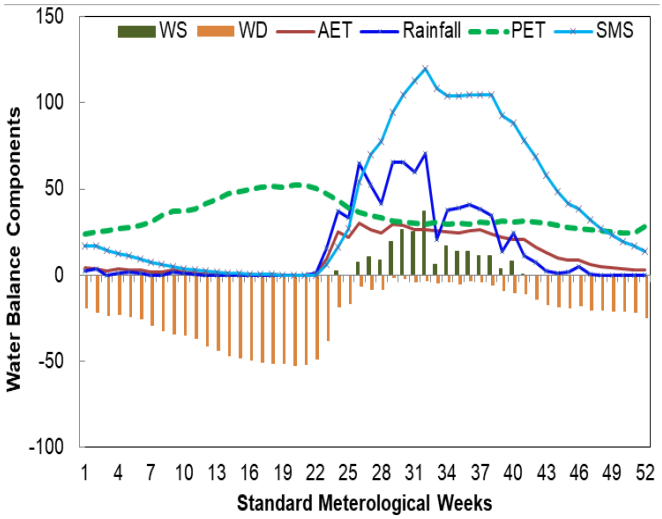

Fig. 1 Average weekly water balance parameter at Kalamb

B. *Water Availability Period*

Under average rainfall condition, the period during which AET was greater than 25% of PET prevailed from 24 to 46 SMW, whereas the period during which AET more than 50% of PET existed during the period from 24 to 42 SMW (Fig. 2). Thus, it was evident that under average rainfall condition, LGP would be as high as 168 days extending from 24 to 46 SMW.

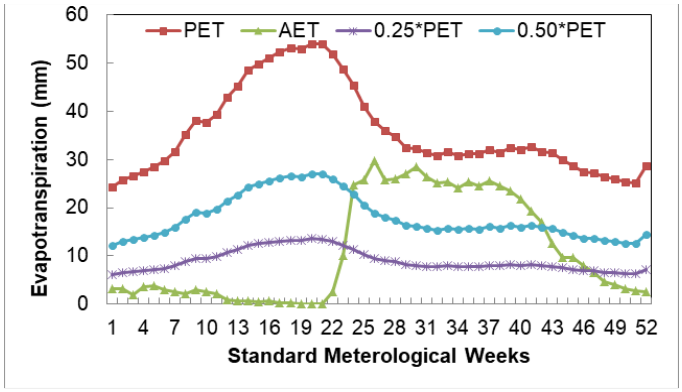

Fig. 2: Water availability period at Ralegoan

V. CONCLUSION

The weeks where rainfall 40 mm is 28 SMW to 36 SMW for consecutive period, could be identified as the growing period of different *Kharif* and *rabi* crop in Ralegoan. Water surplus which includes runoff and deep drainage was found to prevail from 26 SMW to 41 SMW it shows that PET value goes on decreasing throughout the corresponding SMW. This information provides scope for identification of suitable crop varieties to match with the period of water surplus. The 50% of AWHC value prevailed during the period from 24 SMW to 42 SMW, it indicating that under average rainfall condition, crops growing his period during would be able to produce at potential level. The total surplus was 223.55 mm. The results indicate that less number of the years had annual surplus water was less than 200 mm. This surplus water shall be stored in water harvesting structures as provision for protective irrigation.

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