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A CASE STUDY

Weekly water balance of pomegranate in Parbhani district

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SUMMARY : Water balance study is carried out to determine the weekly evapotranspiration, irrigation required and available useful rainfall. Daily rainfall data was collected from Metrological Department, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Daily rainfall were converted to weekly rainfall. Daily reference crop evapotranspiration values were estimated by Penman-Monteith method with help of DSS_ET software. The weekly water requirement and weekly effective rainfall gives an idea about irrigation required. The Pomegranate evapotranspiration in *Ambia* bahar is more as compare to *Mrig* and *Hast* bahar. It observe that supplemental irrigation required in *Mrig* bahar is highest followed by *Hast* and *Ambia* bahar. Rainfall contribution to the Pomegranate evapotranspiration is maximum for *Ambia* Bahar than *Mrig* and *Hast* bahar. number of water deficit weeks maximum in *Mrig* bahar followed by *Ambia* and *Hast* bahar.

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Key Words :
Water balance, Pomegranate, Evapotranspiration, *Ambia* bahar, *Mrig* bahar

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Pomegranate (*Punica granatum* L.) is a drought-hardy crop, suited to arid and semi-arid regions, where the use of marginal water for agriculture is on the rise. The task of monitoring and controlling the field water balance is a valuable tool for efficient management of water and soil. Rainwater is essential source for agriculture, human beings and animals that falls on the surface of earth. This study deals with "effective rainfall", *i.e.* useful rainfall. Agriculturists consider the portion of rainfall effective that directly satisfies crop water requirements. The primary source of water supply for agriculture in most parts of the world is rainfall. The characteristics of rainfall vary from place to place, day to day, month to month and also year to year. Extent of water deficit and surplus for a given region is important in planning for water harvesting structures, artificial ground water recharge and adjusting agricultural operations in such a way so as to bring maximum synchronization between availability of water and critical stages of crop growth. Water deficit is a complex and non-linear phenomenon because it depends on several interacting climatologic factors such as precipitation, temperature, humidity, wind speed, bright sunshine hours, etc. Plant water demand is described in terms of evapotranspiration (ET), which combines two important phenomena occurring simultaneously in the cropped field: evaporation and transpiration. As the amount of water used by plants for metabolic processes is insignificant (less than 1%), the term ET is synonymous with consumptive use (Cu) (Michael, 2006). Seasonal Cu values are useful in scheduling irrigation, and are obtained by summing the daily ET values in a cropped field throughout an entire season. Peak period Cu is particularly useful for irrigation system design, as ET, Kc and Cu are also affected by crop type, plant growth stage and weather conditions (Michael, 2006). Information of the period during which deficiency of moisture in soil are likely to occur is essential so that advance action can be taken to avoid severe moisture stress to the crops. Choice of crop varieties withstanding moisture stress, adoption of appropriate conservation measures and life saving irrigation through recycling surplus water may be possible measures by the advance information.

EXPERIMENTAL METHODOLOGY

The study was carried out for Parbhani

district of Maharashtra state at an altitude of 409 m above mean sea level. Parbhani is intersected by $19^0 08'$ N latitude and $76^0 50'$ E longitude. Daily rainfall data was collected from Metrological Department, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani. Daily rainfall were converted to weekly rainfall. Daily reference crop evapotranspiration values were estimated by Penman (1948) and Monteith (1965) method with help of DSS_ET software. Daily evapotranspiration were converted to weekly reference crop evapotranspiration. The weekly values of Pomegranate crop evapotranspiration were estimated from weekly reference crop evapotranspiration and weekly crop co-efficient values for *Ambia*, *Mrig* and *Hast* bahar.

Difference between Effective rainfall (P) and pomegranate evapotranspiration (ET_p) gives weekly moisture deficit or Excess. A negative value of this difference indicates water deficit, which means that amount water required to fulfill the potential water requirement of pomegrante tree. While positive difference effective rainfall and pomegranate evapotranspiration (ET_p) gives weekly moisture excess.

Water deficit only exists when (P-ETp) is negative and is calculated by the following equation :

$$\textbf{Water deficit} = P - ET_p \quad \text{.....(1)}$$

The water excess is the amount of positive ($P-ET_p$) which remains in excess after recharging the soil to the field capacity and is calculated by the following equation :

$$\textbf{Water excess} = P - ET_p \quad \text{.....(2)}$$

where, P – Rainfall, ET_p – Pomegrante crop evapotranspiuration.

EXPERIMENTAL FINDINGS AND DISCUSSION

Weekly rainfall and pomegranate evapotranspiration data of Parbhani district were analyzed statistically and results are presented in Table 1 gives the weekly water deficit and excess of *Ambie* bahar. Total evapotranspiration of pomegranate in *Ambia* bahar was 1434.86 mm, which having 35 water deficit weeks and 11 excess weeks. Maximum supplemental irrigation water required in *Ambia* bahar is 58.90 mm in 19th week. In *Ambia* bahar the amount of irrigation water required was 857.83 mm. Pomegranate evapotranspiration varies from 3.72 mm in 1st week to 64.96 in 21st week. Rainfall from 25th to 40th week is sufficient to fulfill water requirement of pomegranate accept 30th week. Most of the weeks in *Ambia* babar during flowering and fruit development were water deficit and require supplemental irrigation.

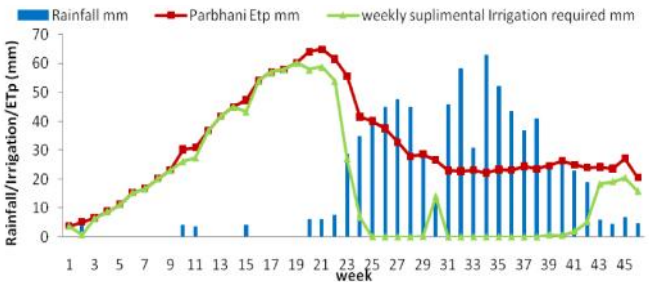

Fig. 1 : Evapotranspiration, rainfall and suplemental irrigation in *Ambia* bahar

Fig. 2 reveals that weekly pomegrante water requirement, rainfall and weekly irrigation requirement of *Mrig* bahar. Total evapotranspiration of pomegranate in *Mrig* bahar was 1403.22 mm, which varies from 3.75mm in 1st week to 47.9 mm in 21st week. *Mrig* bahar have 38 water deficit and 8 water excess weeks. Rainfall from 31st to 40th week is sufficient to fulfill water requirement of pomegranate which is more than the weekly pomegranate evapotranspiration. Maximum irrigation required in *Mrig* babar is 47.90 mm in 19th week. Total supplemental irrigation required in *Mrig* bahar is 974.49 mm. Most of the weeks in *Mrig* babar during fruit development were water deficit and require supplemental irrigation. Flowering period of mrig bahar have excess rainfall than the evapotranspiration which is more suitable for healthy fruits.

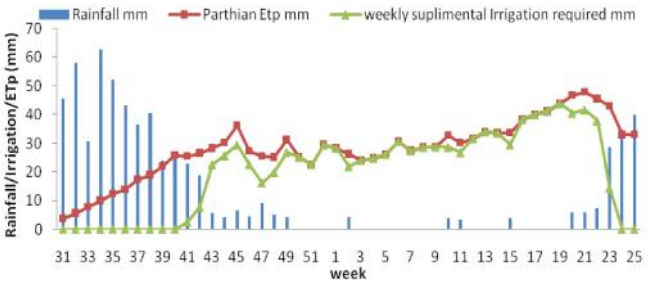

Fig. 2 : Evapotranspiration, rainfall and suplemental irrigation in *Mrig* bahar

Fig. 3 shows that weekly variation of pomegrante water requirement, rainfall and weekly irrigation requirement for *Hast* bahar. Total evapotranspiration of pomegranate in *Hast* bahar was 1324.45 mm. Weekly evapotranspiration in *Hast* bahar varies from 4.19 mm in 42nd week to 49.92 mm in 21st week. *Hast* bahar have 34 water deficit and 11 water excess weeks. Rainfall from 23rd to 34th week is sufficient to fulfill water requirement of pomegranate accept 29th week, which have rainfall more than the weekly pomegranate evapotranspiration. Highest weekly irrigation required in hast bahar is 48.32 mm in 17th week. Gross irrigation required in *Hast* bahar is 945.85 mm. Most of the weeks in *Hast* bahar during flowering and fruit development were water deficit and require supplemental irrigation. Maturity period of *Hast* bahar have excess rainfall than the evapotranspiration which is more sensitive for quality point view. Similar work related to the topic on pomegranate was also done by Naeini *et al.* (2004); Shukla *et al.* (2008) and Gong *et al.* (2007) on apple.

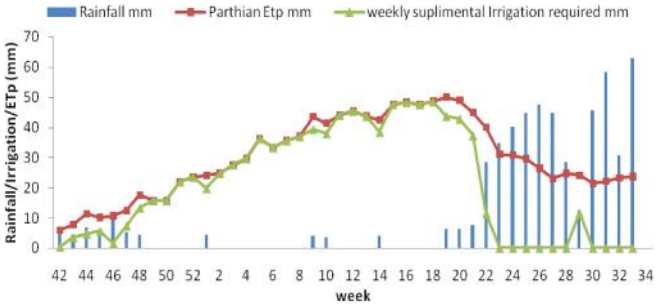

Fig. 3 : Evapotranspiration, rainfall and Suplemental irrigation in *Hast* bahar

Conclusion :

In the water balance study of pomegranate crop in Parthian district it observe that the pomegranate evapotranspiration in *Ambia* bahar is more as compare to *Mrig* and *Hast* bahar. Supplemental irrigation required in *Mrig* bahar is highest followed by *Hast* and *Ambia* bahar. Rainfall contribution to the pomegranate evapotranspiration is maximum for *Ambia* Bahar than *Mrig* and *Hast* bahar.

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