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Short communication

Rainfall probability analysis for crop planning in Shivamogga taluka of Karnataka

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The greatest risk in agriculture production is attributed to the variability of seasonal rainfall and the uncertainty in the amount and its distribution in a given season. The rainfall pattern decides the cultivation of crops, their varieties, adoption of cultural operations and harvesting of excess rain water of any region (Kar, 2002). Generally, the cropping pattern is suggested considering the rainfall probabilities at different levels (Mahale and Dhane, 2003). The weekly distribution of rainfall and its probability is helpful in crop planning by identifying the period of drought, normal and excess rainfall (Ray *et al*., 1980). Gupta *et al*.(1975) suggested that the rainfall at 80 per cent probability could safely be taken as assured rainfall, while 50 per cent probability is the medium limit for taking risk. Shivamogga is known for cultivation of maize, rice and plantation crops mainly arecanut and coconut. In this regard, an attempt has been made to understand the rainfall climatology by analyzing the temporal and spatial rainfall distribution and its probability of occurrence of dry and wet spell and their distribution by analyzing rainfall data ofShivamogga, Karnataka.

Shivamogga taluka having geographical area of 1113 sq.km with latitude of 13°55' N and 75°34' E with an altitude of 609 m above msl. The daily rainfall data of last 50 years (1965-2014) was collected from Karnataka State Natural Disaster Management Center (KSNDMC), Bengaluru. The dry and wet spell analysis was carried out by usingstandard Markov-chain process. Rainfall of 20 mm per week is adequate for all the growthstages of all the crops grown. Thus, if in a given week therainfall received is less than 20 mm, that week can be designatedas a dry week and *vice-versa*. On the basis of this criterion,each week was categorized as a dry week and wet week andrespective probabilities were calculated. The incomplete gamma distribution (IGD) was used to derive expected weekly rainfall at different probability levels (Lamba *et al.,*1990 and Jat *et al.,* 2010).The data was analyzed by using 'Weathercock v 3.1' software developed by Central Research Institute for Dry land Agriculture (CRIDA).

The mean annual rainfall at Shivamogga was found to be 966.5mm and it varied from 410.8 mm (lowest) to 1888.8 mm (highest) with standard deviation (SD) of 337.3 mm and coefficient of variation (CV) of 34.9%. The probability of dry week, P (D) was found to be more than 60% during most of the rainy season period except during 36th and 37th SMW (Fig. 1). The initial dry spell results revealed that, Shivamogga experiences more dry spells at early and middle stages of rainy season. Similar trends were observed with consecutive dry spells also, *i.e.,* with probability of two consecutive dry weeks, P (2D); three consecutive dry weeks, P (3D) and four consecutive dry weeks, (4D). High probability of occurrence of dry spells hint for importance of *in-situ* moisture conservation measures and need of supplementary irrigation during, early and middle stages of rainy season.Hence, farmers need to be cautious while selecting early sowing window to avoid the plausible early season drought. The probability of week being wet P (W) was observed to be more than 50% on 37th week (SMW) during rainy season which is an indication for potential rainwater harvesting which may be utilized during dry spells. Further, critical observation regarding consecutive wet weeks, *i.e.,* P (2W), P (3W) and P (4W) also indicates that, there may be probability of getting rain water for harvesting during 36th to 39th SMW.

The overall dry and wet spell analysis reveal that, dry land crops sowing at Shivamogga can be initiated during 24th and 25th SMW as 24th SMW was found to be mean week of onset of rainy season and comparatively less dry spells were pronounced during mid-rainy season which can be conjunctively planned with *in-situ* moisture conservation measures and supplemental irrigation at critical crop growth periods.The minimum expected weekly rainfall at 10, 25, 50, 75 and 90% probability levels during rainy season were derived and are presented in Fig. 2. The results revealed that, the expected weekly rainfall at 10% probability level ranged between 25.4 mm (48th week) to 134.6 mm (29th week) and at 90% probability level, it varied from 0.1 mm to 12.6 mm. At 75% probability level, the weekly expected rainfall was found to be between 0.7 to 25.0 mm which is an indication

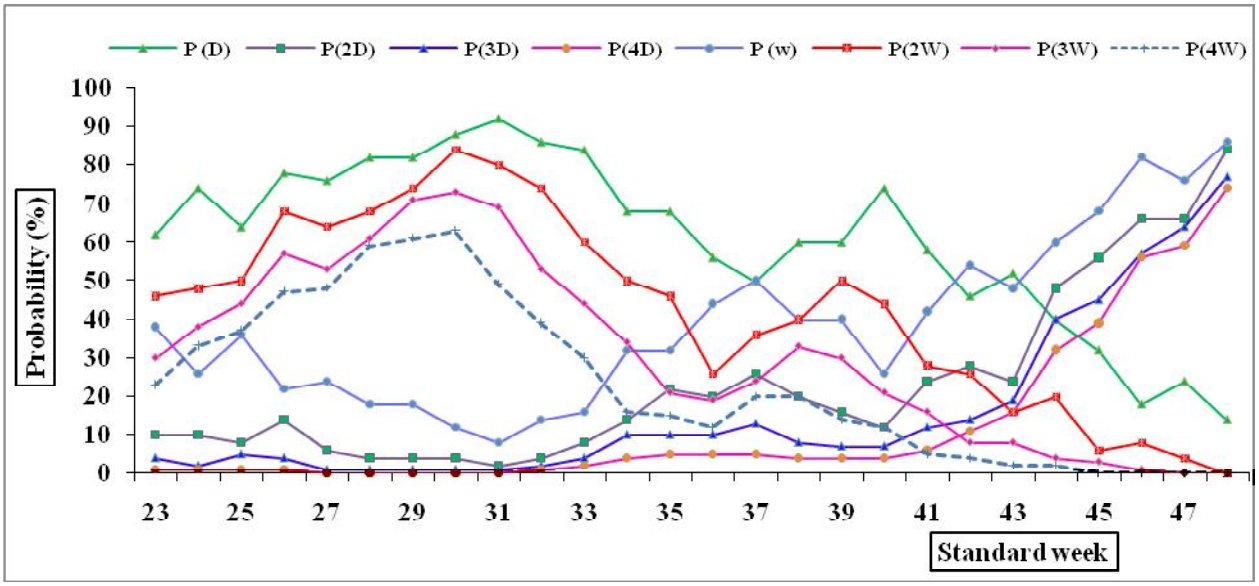

Fig. 1: The initial and consecutive dry and wet week probabilities

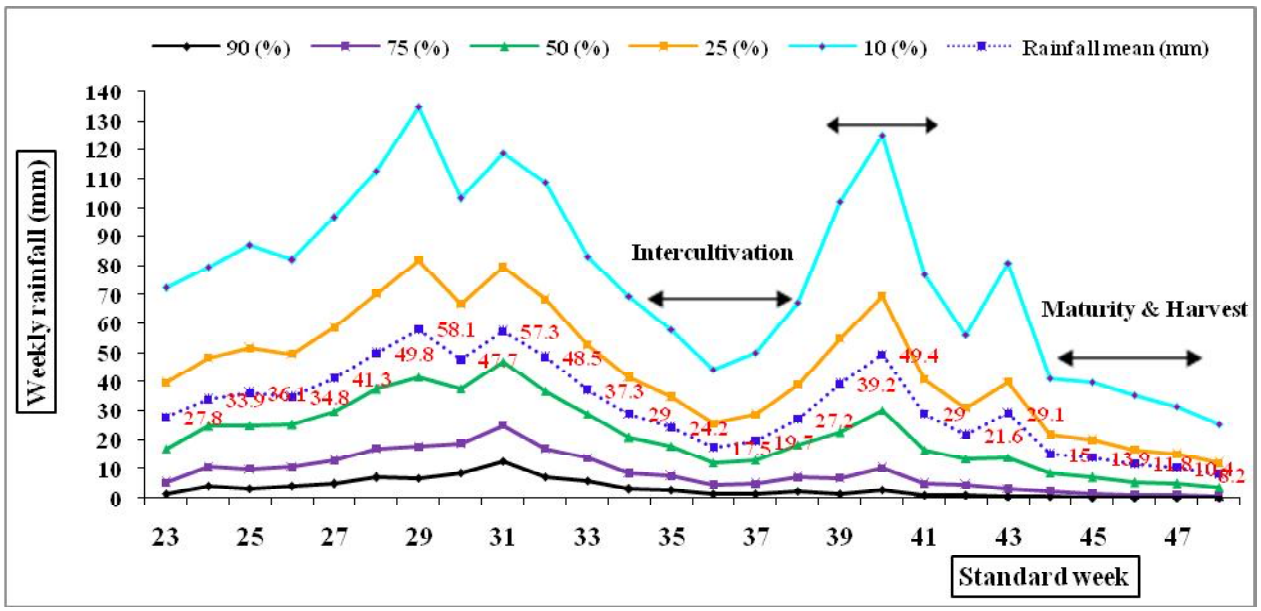

Fig. 2: Weekly rainfall (mm) of different probabilities and agronomic practices at Shivamogga

of deficit rainfall during rainy season weeks which in turn indicates high risk for growing dryland crops which are likely to suffer by frequent dry spells.

Crop planning and management

The major crops of Shivamogga were maize, paddy, ragi,Jowar and tobacco during *kharif* season with about120-140days duration for high yielding varieties. This analysis clearly indicates that the rainfall received during May could be utilized for land preparation and sowing of long duration rainfed crops and nursery preparation for tobacco.Optimum time for sowing of *kharif* season crops would be23rd 26thSMW(first and second fortnight of June)with average weekly rainfall of 16.8, 24.7, 25.0 and 25.1mm, respectively at 50 % probability level. The inter-cultivation and other operations can be taken up during 35th to 38thSMW with an average weekly rainfall of 17.7, 12.0, 13.1 and 18.4 mm. The crop sown during 23rd-26th week, reaches the maximum growth or grand growth period during 39th to 42ndweek, during this stage crop requires highest amount of water, which is available during the period. Hence, successful dependable rainfed cropping of cereals/pulses can be taken up during South-west monsoon. Apart from this irrigation to the plantation crops like arecanut and coconut as well as other horticultural crops may be skipped to save the water. Higher probability value of $P_{(W)}$ and $P_{(W/W)}$ in this period indicate

that there are higher chance of week being wet and even if previous week was dry, the higher probabilities of $P_{(W/D)}$ in this period says that chance of present week being wet is high.However, double cropping is possible depending upon the availability of adequate soil moisture for succeeding crop. The sowing of second crop of short duration pulses like horse gram, green gram and black gram and oil seed croplike sunflower is possible immediately after harvest of first crop.

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