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EFFECT OF PREMONSOON DRYSEEDING EMPLOYING RAINFALL PREDICTION IN VERTISOLS OF ARUPPUKKOTTAI TALUK

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ABSTRACT

Thirty one years of rainfall data of Aruppukottai in Virudhunagar district were analysed for variability indicated the "Uni" model distribution pattern. Weekly rainfall prediction were made for dry seeding on vertisols. Thrity seventh STD week (Sep 10-16) had the probability of 73 per cent for 20 mm rainfall. The probability for 10 mm of rainfall in the subsequent weeks remained more than 60 per cent. Dry seeding possibility in sorghum and cotton during 35 and 36th week has been indicated. A model with minimum assured rainfall at 50 per cent probability in conjunciton with moisture availability index was developed and validated through on-farm trials in the farmers holdings. The yield increase in sorghum was 36 per cent over the monsoon crops. This technique was useful for other vertisol areas with uni model rainfall pattern with primary peak in the month of October.

KEY WORDS : Rainfall prediction, dry seeding, vertisols

In drylands, crop production is hampered by many constraints of which the rainfall is the major one as it forms the only source for soil moisture. Rainfall in the semi-arid tropics is not only low in quantity but also erratic and undependable in distribution. The length of growing season depends on date of receipt of rains for sowing and cessation of the same. Virmani and Piarasingh (1986) defined the onset of sowing rain as that a rainfed crop could be sown during a week which received 20 mm of rain in one or two consecutive days provided the following week received 10 mm rainfall at 70 per cent probability. The end of rainy season could be identified as the week, provided the weekly rainfall of subsequent week fell below 0.25 times of PET continuously (Ramana Rao, 1988). The technique for dry seeding which involves the sowing of seeds in dry soil especially for vertisols has been developed to make use of the pre-monsoon showers received. Pothiraj (1982) reported that pre-monsoon dry seeding of rainfed cotton at 38th standard week at Coimbatore was optimum for higher yield. Keeping this in view, the rainfall data of Arupukottai taluk in Virudhunagar district were analysed to determine the optimum week for dry seeding in vertisols.

MATERIALS AND METHODS

The historical rainfall data for 31 years (1959-89) were collected from the Revenue Department. The data were analysed for annual, seasonal, monthly and weekly variability through a computer programme (Chinnamuthu *et al.*, 1991). Conditional probability for specific quantity of rainfall) was worked out by adopting the method developed by Gopalaswamy *et al.* (1988). The resultant quotient was referred to 'Z' table for finding the probability. The initial probability (quantity of rainfall for fixed probability) was worked out for weekly data. The moisture availability index (MAI) was workedout as suggested by Hargreaves (1974).

The PET data worked out by Subramanian and Kulandaivelu (1986) were utilised. A model has been developed based on the minimum assured rainfall at 50 per cent probability for sorghum crop and validated in the farmers holdings in the taluk at seven places including the Regional Research Station through on farm trails.

RESULTS AND DISCUSSION

The mean annual rainfall of Aruppukottai taluk was 780 mm. The highest rainfall of 1174 mm was recorded in the year 1960. Out of 31 years of rainfall in 16 years rainfall was normal (-19 to 19%), 8 years excess (26 to 59%) and 7 years deficit (-20 to -59%). The coefficient of variation (CV) was 26.2 per cent which indicated fairly good dependability. From the rainfall data, it was observed that there was no regular periodicity in the occurrence of deficit or excess rainfall.

Seasonal rainfall

The contribution by the North-East monsoon (NEM) was the highest (390 mm) to the tune of 50.1 percent, followed South-West monsoon (SWM) (208 mm) to the extent of 26.7 per cent. The summer and winter seasons received 18.6 and 4.5 per cents respectively. The NEM is more dependable with a CV of 43.5 per cent followed by SWM (43.9%). In all the seasons, summer rainfall was more dependable with the least CV of 37 per cent.

Monthly rainfall

The month of October recorded the highest mean rainfall of 221 mm with the lowest CV of 60 per cent, closely followed by 113 mm. About 50 per cent of NEM rainfall was received during the month of September as pre-monsoon showers the transitional period between SWM and NEM.

Weekly rainfall

The highest quantity of rainfall was received during the 43rd week in the NEM period. It was observed that the mean weekly rainfall was greater than 20 mm from 37th to 47th STD weeks. Knowing the variability of rainfall at shorter interval could be used for taking up decisions in the day to day operation especially in drylands.

Table 1. Rainfall conditional probability

STD Week	Date	Probability for the RF %		
		10 mm	20 mm	30 mm
31	July 30- Aug 5	56.7	45.6	34.8
32	Aug 6- Aug 12	55.2	48.0	34.8
33	Aug 13- Aug 19	35.6	20.9	10.7
34	Aug 20- Aug 26	53.6	33.0	18.4
35	Aug 27- Sep 2	56.6	48.8	40.5
36	Sep 3- Sep 9	53.9	45.2	33.0
37	Sep 10- Sep 16	75.5	72.9	69.9
38	Sep 17- Sep 23	64.5	54.8	44.4
39	Sep 24- Sep 30	63.7	56.4	51.2

Rainfall prediction

The quantity of rainfall required for a particular operation had to be predicted well in advance which is provided by conditional probability. In the present context, the receipt of sowing rains (20 mm) during the pre-monsoon periods with their conditional probability are presented (Table 1). The probability of getting sowing rains during 37th STD week (10-16th September) was 72.9 per cent exceeding two-third level. Further, the chance of getting 10mm in the subsequent week remains 65 per cent. In view of higher probability for sowing rains, dry seeding of sorghum and cotton could be taken up two weeks in advance i.e. during 35th (Aug 27th to Sep 2nd) and 36th STD week (Sep 3rd to 9th) in vertisols.

Dry seeding model

The assured rainfall at 50 per cent probability was taken from 35th to 52nd STD week (Table 2). From the minimum assured rainfall, a model to indicate the potentials for dry seeding in respect of sorghum crop is discussed. A crop seeded in dry soil during 35th STD week germinate during 37 th STD week when sowing rains are recorded. The duration of phenological phases of sorghum

Table 2. Rainfall at 50 per cent probability (mm) and MAI value crop- sorghum 110 days duration

Phenological phases	Duration (weeks)	PMDS crop		MWS crop	
		RF (mm)	MAI	RF (mm)	MAI
Seedling phase	0-3	55.7	0.293	105.4	0.726
Vegetative phase	4-6	125.2	0.726	79.0	1.198
Flowering phase	7-10	56.3	1.198	25.5	0.260
Maturity phase	11-16	15.6	0.197	Nil	Nil
Total		252.8		210.2	

Table 3. Yield of sorghum and cotton under dry and wet seeded condition

Place of onfarm trial	Sorghum Grain (Kg/ha)		Cotton seed cotton (q/ha)	
	Premonsoon	Monsoon	Premonsoon	Monsoon
Kalurani	1560	1056	4.1	2.2
Kattankudi	1770	1426	5.3	3.9
Kalkurichi	1818	1415	3.9	2.7
Palayampatti	1717	1120	4.7	3.8
Karimangalam	1670	1220	3.2	2.3
Regional Research Station, Aruppukkottai	1920	1250	5.7	3.9
Mean	1751	1279	4.3	3.1
Per cent over Monsoon crop	36		39.9	

considered are seedling phase 0-3 weeks, vegetative phase 4 to 6 weeks, flowering phase 7-10 weeks and maturity phase 11 to 16 weeks.

A pre-monsoon dry seeded crop (PMDS) would received about 56 mm of rainfall whereas the monsoon wet seeded crop (MWS) gets about 105 mm. The rainfall during seedling stage of MWS crop is quite excess which may lead to seedling mortality, leaching of nutrient and favour more weed growth. During vegetative phase the PMDS crop enjoys the benefit of increased quantum of rainfall (125.2 mm) whereas the MWS crop gets 79 mm. The increased amount of rainfall during vegetative phase might be favourable for plants to acquire adequate vegetative structures in terms of plant height and LAI. The amount of rainfall received during flowering phase by the PMDS crop is about 56 mm as against 26 mm by the MWS crops. During the maturity phase PMDS crop only gets 16 mm of rainfall. In the absence of any rainfall during the maturity phase the MWS crop has to grow only on the residual moisture and the crop is likely to undergo "Terminal Stress" at the expense of yield. A considerable yield increase is possible in PMDS crop on account of higher rainfall during flowering phase which is sensitive to moisture stress. Even a reduction of 25 mm of rainfall below the threshold required during the critical phases may lead to complete failure of grain production conversely 50 mm above the threshold may even double the yield.

The moisture availability index (MAI) indicates the ratio between the dependable precipitation and potential evapotranspiration. A value of 0.25 during germination and seedling stages and 0.5 thereafter is required for successful cropping in dryland. In the present context the weekly MAI values for PMDS and MWS (Table 2) crops have been compared. In the case of MWS crop, the MAI values very high during seedling and vegetative phase indicating surplus moisture as compared to PMDS crops. Conversely during flowering phase, the value was about 50 per cent of requirement while the value was more by 4 times with PMDS crops. Since, the flowering stage is quite critical for moisture the stress would affect the yield of MWS crops.

Validation of the models

The model was validated during 1993-94 by conducting field trials on the farmers holdings with cotton and sorghum in each 0.20 ha. Seven locations which are having vertisols including the Regional Research Station, Aruppukottai were selected. The ruling variety in sorghum (CO 26) and cotton (MCU 11) were sown during 35th and 40th week to represent PMDS and MWS. following the recommended package of practices. The names of the locations and yield data are furnished in Table 3. Grain yield increase in sorghum was 36 per cent with PMDS crop over the MWS crops and in cotton it was 39.9 per cent. The results have clearly brought out the superiority of Pre-monsoon dry seeding. The increased yield might be attributed to the effective utilisation of pre-monsoon showers for crop establishment. Studies on dry seeding of sorghum in deep vertisols at Bijapur revealed an yield increase to the tune of 47 and 75 per cent respectively in grain and grain yields over to conventional wet seeding.

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GROWTH AND MINERAL NUTRIENT COMPOSITION OF SIX CULTIVARS OF GREEN GRAM GROWN AT NORMAL AND DEFICIENT LEVELS OF IRON SUPPLY

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ABSTRACT

Iron deficiency caused two to three fold reduction in photosynthetic rate, leaf area specific leaf weight and total chlorphyll content in green gram Kondaveedu cultivar. The total dry matter increased proportionately as the Fe level increased in the medium. Variation was observed between green gram cultivars in Fe absorption and utilisation. LAM 88-4 was highly susceptible to Fe stress. CVS. PIMS-4 and ML 267 were moderately susceptible and RGG 79-1-12 and PS 16 were less susceptible and performed well under Fe stress conditions. The concentration of total Fe, Zn and Mn antogonistic to iron increased and orthophenanthorline Fe gave good index of chlorosis in green gram cultivars.

KEY WORDS : Iron deficiency, mineral composition, green gram cultivars

Iron is essential for plant growth because of its involvement in photosynthetic activity. The deficiency of Fe in the growth media may alter the inorganic composition and growth of the plants. It is well known that plant species and cultivars within species differ in their response to Fe stress. Since no serious effort was made to investigate the effect of iron deficiency on growth and mineral nutrient composition in green gram (*Vigna radiata* L.) cultivars, this experiment was conducted.

MATERIALS AND METHODS

The experiment was conducted in solution culture. Seed of green gram (*Vigna radiata* L.) Cv. Kondaveedu were sown in plastic troughs containing acid washed quartz sand. One week old seedlings were transferred to 7 l capacity plastic containers containing modified Hoagland nutrient solution (Johnson *et al.*, 1957) having 0, 0.10, 0.50, 1.0 and 5.0 ppm of Fe. Each treatment had five replications and each replication three seedlings were maintained. The culture solution was aerated by bubbling air into the solution. The solutions were changed at weekly intervals and the plants were sampled 25 days after transplanting. The sampled plants were dried at 80°C for 48h and dry weights determined. The leaves were analysed for P, total Fe, physiologically active Fe, Zn, Mn and Cu contents through routine methods. Specific leaf weight (SLW), net photosynthetic rate (NPR) and total chlorophyll content (TCC) were also determined.

In a separate experiment five cultivars of green gram *viz.*, RGG 79-4-12, PS 16, PIMS 4, ML 267 and LAM 88-4 were selected to study their response to Fe stress. Each cultivar received complete nutrient solution with Fe (5.0 ppm, control) and nutrient solution defecient in Fe (0