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A study of rainfall pattern in relation to crop planning over the Haryana State

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ABSTRACT. Haryana State receives a range of 200 to 1200 mm of annual rainfall in 7 agroclimatic zones. The rainfall patterns of these zones have been discussed with special reference to the amount, variation and probabilities based on the rainfall data of the rain recording stations. The existing cropping patterns have been analysed at block level in relation to rainfall pattern, variability etc.

1. Introduction

Since nearly 60 per cent of area is under rainfed conditions the dryland agriculture will continue to play a significant role in food production. The study of rainfall pattern of the State is therefore essential for better crop planning, screening of suitable varieties and agronomic practices. The National Commission on Agriculture (1973) studied the rainfall zones and cropping patterns of the State. The main features of the study are : (*i*) the use of the taluk as unit of area for compilation of crop and all related statistics, (*ii*) demarcation of the State into rainfall zones based on monthly rainfall distribution throughout the year and (*iii*) analysis of crop, livestock distributions etc in each zone. The present study was undertaken to extend the analysis on the same lines but using block as unit of area.

2. Materials and Methods

The distribution of rainfall during the various stages of crop growth is more important than seasonal totals. To facilitate analysis in this manner, the limits of monthly rainfall given in NCA's paper for the different crops are :

Rainfall (cm per month)	*Code letter*
(*i*) Greater than 30	A
(*ii*) 20 – 30	B
(*iii*) 10 – 20	C
(*iv*) 5 – 10	D
(*v*) Less than 5	E

In view of the importance of winter rainfall, though small, we divide E further into two classes :

(*vi*) 2 – 5 cm	E
(*vi*) less than 2 cm	F

In this study, the above six classes of rainfall intervals with their associated code letters A to F are used in drawing up the monthly distributions throughout the year for all the raingauge stations in the State. When, in a distribution, a number of months are within the same rainfall limits, the appropriate code figure is given a numerical subscript to denote the number of months. *e.g.*, B_2 denotes two months with rainfall class B(20 – 30 cm pm).

For convenience, the distribution in coded form follows the order March to May (June to September) October to February. June to September, the southwest monsoon season, the main rainy season is shown in brackets in the middle followed to the right by the winter period. In each of the parts of the coded form, the descending order of rainfall limits (*i.e.*, A to F) is employed. As the main rainy months of the State are known to be July and August, there should not be much difficulty in the rainfall distributions of the different months. As an example, we give the rainfall distribution of Ambala.

$$E_1\ F_2\ (B_2\ C_1\ D_1)\ E_2\ F_3$$

Its decoded version is as follows : One month (March) is in 2-5 cm class and April and May less than 2 cm pm; July and August are in 20-30 cm pm class followed by 10-20 cm in September and June rainfall is in 5-10 cm class; January and February each receive 2-5 cm pm and the remainder months October to December get less than 2 cm pm.

Rainfall averages are available for 65 stations of the State and the periods of data vary 30 to 56 years. All stations with the same rainfall distribution have been joined and the zones in the State demarcated; these are seven in number and

are shown in Fig. 7 with their respective areas in sq. km and also in Table 1(a). In a fifth of the State, there is no month in the year with an average exceeding 10 cm. Two third of the State gets more than 10 cm pm in July and August. Only about 15 per cent area in the State receives more than 20 cm pm in July and August. About 25 per cent of the State has a rainfall distribution with not less than 10 cm pm for three consecutive months July to September.

3. Cropping zones

The area statistics of various crops at block level under rainfed conditions have been analysed. The cropped area of each crop was expressed, as a percentage of the total cropped area and then the decreasing order of various crops was considered for constituting cropping pattern. The following code letters have been used for various crops and the subscript denotes the category of percentage area.

Name of the crop	*Code representation*
Gram	G
Bajra	B
Kharif Fodder	KF
Rabi Fodder	RF
Rabi Oilseed	RO
Barley	BA
Guar	GU
Wheat	W
Jowar	J
Rabi Pulses	RP
Maize	M
Sugarcane	S
Paddy	P
Groundnut	GR
Moth	MH
Moong	MO
Grasses	GS
Urd	U
Arhar	A
Taramira	T
Sarson	SA
Raya	R

Subscript Code	*Explanation*
1	70 per cent or more of the total cultivated area
2	50-70 per cent of the total cultivated area
3	30-50 per cent of the total cultivated area
4	10-30 per cent of the total cultivated area
5	5-10 per cent of the total cultivated area
6	Less than 5 per cent of the total cultivated area

4. Rainfall variation

(*i*) *Median of dry spell periods in southwest monsoon season* — The dry spell is defined as a period of at least 5 consecutive rainless days. A day with less than 2·5 mm rainfall has been considered as a dry day. The median of dry spell periods during the southwest monsoon season of each of the raingauge stations has been computed and isohytes of these are shown in Fig. 6.

(*ii*) *Statistical parameters* — The coefficient of variation of rainfall for 65 raingauge stations for the southwest monsoon months and for a winter month January, have been presented in Figs. 1-4. The first, second, third and fourth quintiles of rainfall for the same period have been determined by arranging the data in ascending order of magnitude. The quintile figures will indicate the amount of rainfall that will be exceeded in 8, 6, 4 and 2 years out of ten respectively.

(*iii*) *Annual, seasonal and monthly variations*— 75 to 80 per cent of annual rainfall is received during the southwest monsoon season. In the southwest regions, less than 300-500 mm of rainfall is received, whereas along the northeast parts of the State rainfall is more than 600-1000 mm.

Coefficient of variation (C. V.) of annual rainfall ranges from 20 per cent in high rainfall areas of Ambala district to over 50 per cent in the low rainfall areas of district Sirsa.

Coefficient of variation of southwest monsoon season rainfall varies from 20-30 per cent in the Ambala and Karnal districts to 60-70 per cent in western region (Fig. 1). The C. V. of winter season rainfall (October to March) ranges from 70 per cent in the Ambala district to 100 per cent in southwestern region of the State. This indicates that the rainfall is highly erratic over the State.

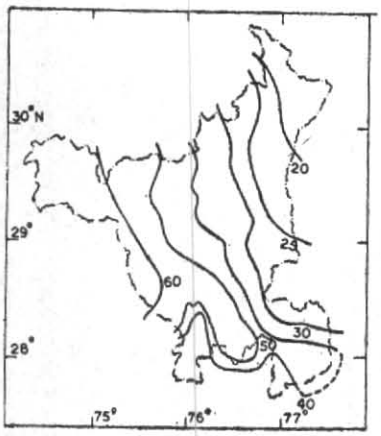

Fig. 1. SW Monsoon Season (Jun–Sep)

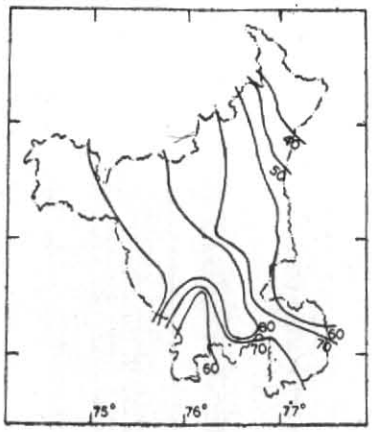

Fig 2. July

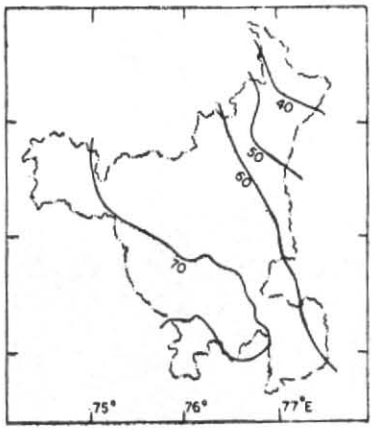

Fig 3. August

Figs. 1–3. Coefficient of variation (C.V.) of rainfall over Haryana

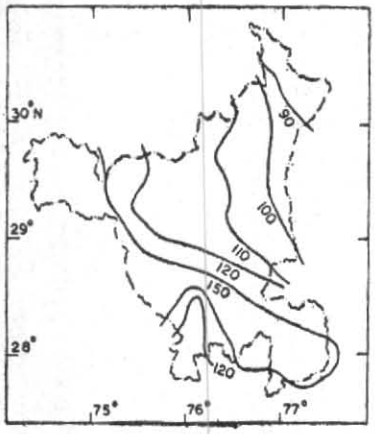

Fig. 4. C.V. rainfall in Jan over Haryana

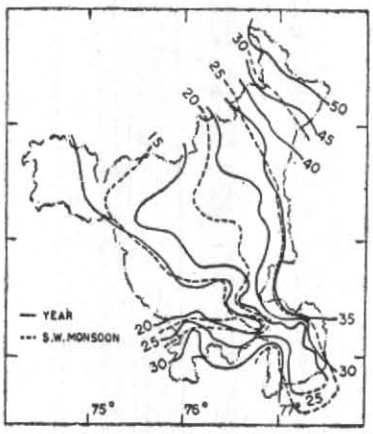

Fig. 5. No. of rainy days in Haryana

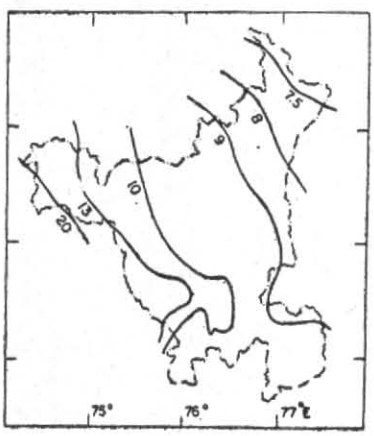

Fig. 6. Median of dry spells in SW monsoon season over Haryana

The monthly C. V. is lowest in the months of July to August, it being 40 to 60 per cent in higher rainfall areas of 70-90 per cent in the western region (Figs. 2 & 3). During the winter season 50-100 C. V. is found all over the State except the western regions where it is still higher. In the winter month January, C. V. is 90 to 150 per cent over the State (Fig. 4). Rainfall variability is higher in winter season as compared to the southwest monsoon season. The average number of rainy days (rainfall greater than 2·5 mm) during the southwest monsoon season varies from 12 to 35. The average annual number of rainy days varies from 20 in Sirsa to 50 days in Naraingarh area. The number of rainy days increases with the increase of seasonal rainfall (Fig. 5).

(*iv*) The median of dry spell periods (Fig. 6) in the southwest regions varies from 10 to 20 days indicating that crop will have to tolerate this moistureless period or soil moisture storage must

TABLE 1 (a)

Rainfall zones and their cropping patterns

Zone No.	Rainfall zones	Geographical area covered by the zone (Per cent)	Average cropping pattern of the zones
1	$F_3 (D_3 E_1) F_5$	18·1	$G_3 B_4 RO_4 KF_5$
2	$F_3 (C_1 D_2 E_1) F_5$	12·3	$B_3 G_4 RO_5 GU_5$
3	$F_3 (C_2 D_1 E_1) F_5$	36.0	$B_3 G_4 J_4 RO_5 W_6$
4	$F_3 (C_3 D_1) E_1 F_4$	17·4	$B_4 G_4 W_4 BA_4 GU_5 RO_5$
5	$F_3 (B_2 D_2) E_1 F_4$	6.9	$W_4 M_4 G_4 KF_4 RF_6$
6	$E_1 F_2 (B_2 C_1 D_1) E_2 F_3$	4·8	$W_4 G_4 M_4 P_5 B_5 KF_4$
7	$E_1 F_2 (A_2 C_1 D_1) E_3 F_2$	4.4	$M_4 G_4 W_4 P_5 S_5 GN_6 KP_6 KF_4$

TABLE 1 (b)

Cropping pattern of various blocks under rainfed conditions in the various zones

Zone	District	Block	Cropping pattern
1	Sirsa	Sirsa	$G_3\ B_3\ KF_4\ RO_5$
		Rania	$G_2\ B_4\ RO_4\ KF_4$
		Baragudah	$G_3\ B_4\ RO_4\ KF_4$
		Dabawali	$G_3\ B_4\ RO_5\ KF_4$
	Hissar	Fatehbad	$G_3\ B_3\ RO_4$
		Ratia	$G_3\ B_3\ RO_4$
		Bhuna	$G_3\ B_3\ RO_4$
	Rohtak	Nahar	$G_3\ B_4\ J_4\ GU_5$
		Salhawas	$B_3\ G_4\ GU_4\ J_4\ RO_5$
	Bhiwani	Tosham	$G_3\ B_3\ RO_5$
2	Hissar	Tohana	$B_2\ G_4\ RO_5$
		Hissar II	$B_3\ G_3\ RO_4$
		Hansi II	$B_3\ G_3$
	Bhiwani	Bwani Khera	$B_3\ G_4\ RO_4\ GU_4$
		Bhiwani	$B_3\ G_4\ GU_4\ RO_5$
		Loharu	$B_3\ G_4\ GU_4\ RO_5$
		Bhadra	$B_2\ G_3\ GU_5\ KF_5$
	Jind	Narwana	$B_2\ G_3\ J_4$
3	Jind	Kalayat	$B_3\ G_3\ J_5\ BA_5$
		Uchana	$G_3\ B_3\ RO_4\ J_5$
		Rajaund	$B_3\ G_3\ J_5$
		Saffidon	$B_3\ G_4\ J_4\ RO_5\ BA_5$
		Jind	$B_3\ G_3\ J_4\ BA_5$
		Julana	$B_3\ G_3\ J_4$
	Hissar	Narnaud	$B_2\ G_3\ KF_5\ BA_5$
		Hansi I	$B_2\ G_4\ RO_5$
		Barwala	$G_2B_3\ RO_4$
		Hissar I	$G_2\ B_3$
	Karnal	Asandh	$G_4\ B_4\ W_4\ M_4\ KF_4\ RP_5$
	Kurukshetra	Gulah	$G_3\ M_5\ B_5\ W_5\ KF_5$
		Kaithal	$G_4\ B_4\ W_4\ KF_4\ BA_4J_5M_5$
	Rohtak	Maham	$B_3\ J_4\ G_4\ GU_5$
		Rohtak	$G_4\ B_4\ J_4\ W_4\ GU_4$
		Sampla	$W_4\ G_4\ B_4\ J_4\ GU_4$
		Beri	$G_2\ B_4\ J_4\ GU_5$
		Kalanaur	$B_4\ G_4\ W_4\ J_4\ GU_4\ RO_5$
	Sonepat	Mundlana	$W_4\ B_4\ G_4\ KF_5$
		Gohana	$W_3\ B_4\ G_4\ BA_5\ KF_5$
		Kharkhauda	$B_3\ W_4\ G_4\ BA_5\ KF_5$
		Kathura	$W_3\ B_4\ G_4\ KF_5$
	Bhiwani	Dadri I	$B_2\ G_3\ GU_5\ KF_5$
		Dadri II	$B_2\ G_3\ KF_5\ GU_5$
3	Mohindergarh	Mohindergarh I	$B_2\ G_4\ GU_4\ BA_5\ RO_5$
		Mohindergarh II	$B_2\ G_4\ GU_4\ RO_5$
3	Mohindergarh	Narnaul I	$B_3\ G_3\ GU_5\ BA_5\ RO_5$
		Narnaul II	$G_3\ B_4\ RO_4\ BA_5\ GU_5$
		Khol	$B_2\ G_4\ RO_4\ GU_5\ BA_5$
		Bawal	$B_2\ G_4\ RO_4$
		Rewari	$B_2\ G_4\ GU_4\ RO_5$
		Nagan Chaudhary	$B_3\ G_4\ RO_4\ RP_5\ BA_5$
	Gurgaon	Pataudi	$B_2\ G_4\ A_5\ KF_5\ BA_5$
		Nuh	$B_4\ G_4\ RD_4\ W_4\ BA_4\ KF_5$
		Hodel	$B_4\ G_4\ BA_4\ GU_4\ KF_5$
4		Ferozpurjhirka	$G_4\ B_4\ RO_4\ W_4\ BA_4\ KF$
		Hathin	$B_3\ G_4\ KF_5\ GU_5$
		Gurgaon	$G_3\ B_3\ GU_5\ W_5\ BA_5\ RO_5$
		Punhana	$G_4\ B_4\ W_4\ BA_5\ RO_5\ GU_5$
		Palwal	$B_4\ G_4\ BA_4\ GU_5\ W_5\ KF_5$
		Sohna	$B_3\ G_4\ W_4\ BA_4\ RO_5\ GU_5$
		Ballabhgarh	$BA_4\ W_4\ G_3\ B_4\ RO_5\ KF_5\ GU_4$
	Rohtak	Jhajjar	$B_3\ G_4\ J_4\ GU_5$
		Bahadurgarh	$G_4\ B_4\ J_4\ GU_4\ W_5\ BA_5\ RO_5$
	Sonepat	Rai	$W_4\ B_4\ G_4\ BA_5\ KF_4$
		Sonepat	$B_4\ W_4\ M_4\ G_5\ KF_4$
		Ganaur	$G_4\ B_4\ W_4\ M_4\ KF_4$
	Karnal	Smalkha	$W_3\ B_4\ M_4\ G_4\ KF_5$
		Madlauda	$W_3\ B_4\ KF_4\ G_4$
		Nissang	$G_4\ M_4\ W_4\ B_5\ RP_5\ KF_5$
		Nilokheri	$G_4\ M_4\ W_5\ RP_5\ B_5\ KF_5$
	Kurushetra	Pundri	$G_4\ B_4\ W_4\ BA_5\ M_5\ KF_4$
5	Karnal	Panipat	$W_4\ M_4\ B_4\ G_4\ KF_4$
		Gharunda	$W_3\ M_3\ KF_4\ G_4$
		Karnal	$M_4\ W_4\ G_4\ KF_4$
	Kurushetra	Ladwa	$G_4\ M_4\ W_4\ RP_5\ S_5\ KF_4$
		Kurushetra	$G_4\ M_4\ W_4\ RP_5\ KF_4$
		Shahabad	$G_4\ M_4\ W_4\ RP_5\ KF_4$
6	Gurgaon	Faridabad	$B_3\ G_4\ KF_4\ W_5\ GU_5$
	Ambala	Jagadhri	$M_4\ W_4\ G_4\ P_4\ S_4\ KP_4\ KF_4$
		Ambala	$W_4\ G_4\ M_4\ P_4\ KF_4$
		Barara	$W_4\ M_4\ G_4\ KF_4\ P_4S_5KP_5$
7	Ambala	Naraingarh	$M_4\ G_4\ W_4\ P_4\ B_5KP_5KF_4$
	Ambala	Raipur Rani	$M_4\ G_4\ W_4\ GR_4\ KF_5\ P_5$
		Kalka	$G_3\ M_4\ W_4\ KF_4\ KP_4$
		Bilaspur	$W_4\ G_4\ M_4\ P_4\ S_4\ KF_4\ KP_5$
		Chhachharuli	$M_4\ W_4\ G_4\ S_4\ P_5\ B_5\ KF_4\ KP_5$

be sufficient to meet the evapotranspiration demand. In the northeast region the median of the dry spell is 7-8 days; this is high rainfall (greater than 750 mm) region and soil moisture storage is available to meet the evapotranspiration demand over a week. In the southern and central Haryana, the median of dry spells is 8 to 10 days. Suitable moisture conservation measures should enable crops to stand dry period of 7 to 10 days.

5. Rainfall and cropping pattern

Based on the methods described in para 2 above the rainfall zones and cropping patterns have been prepared and are presented in Tables 1(a), 1(b) and rainfall zones only in Fig. 7.

The western region of State is covered under the rainfall pattern F_3 (D_3 E_1) F_5 indicating that during each of the monsoon months (July to September) only 50-100 mm of rainfall is received whereas outside the monsoon less than 20 mm rainfall is received during each of the months. The actual cropping pattern in this zone is C_3 B_4 RO_4 KF_5 which indicates the rainfall is conserved in the soil so as to utilize it for the rabi crops. However, the low water requirement crops can be introduced in this region successfully such as mong, moth, ephemeral grasses. In case of rabi oilseeds the low water requirements crop taramira should be preferred. gram, bajra, rabi oilseeds and kharif fodder crops cover 42·1, 30·2, 8·2 and 8·7 per cent areas respectively.

The region under F_3 (C_1 D_2 E_1) F_5 rainfall pattern has B_3 G_4 RO_5 GU_5 as the cropping pattern. Here also the low water requirement crops like bajra, moong, taramira, raya and fodder crops should be preferred. In this zone bajra, gram rabi oilseeds and guar cover 45·3, 28·8, 8·5 and 8·8 per cent areas respectively.

The next important belt is under the rainfall pattern F_3 (C_2 D_1 E_1) F_5 indicating that July and August will receive on an average 100-200 mm rainfall per month and during September only 50-100 mm. Outside the SW monsoon season, each of the eight months receives less than 20 mm rainfall. The cropping pattern in this zone is B_3 G_4 J_4 RO_5 W_6. Thus this zone can be used for crops like bajra, guar, cowpeas, moong, jowar as kharif fodder, raya, sarson and gram. In these above mentioned three rainfall zones only one crop is possible either kharif on current rainfall, during the southwest monsoon season or rabi on the conserved moisture of southwest monsoon season as the probability of getting the October rainfall is 2 to 10 per cent. In this zone bajra, gram, jowar, rabi oilseeds and wheat crops cover 39·9, 27·9, 7·7, 5·1 and 4·9 % areas respectively.

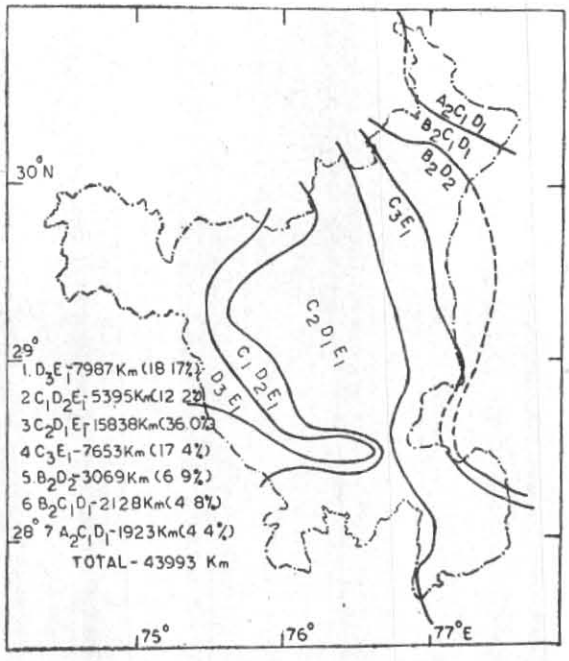

Fig. 7. Haryana rainfall patterns

The fourth rainfall zone is with the pattern as F_3 (C_3 D_1) E_1 F_4. July to September months receive a rainfall of 100-200 mm per month and June is under 50-100 mm class. Outside the southwest monsoon season, except January each of the month receives less than 20 mm rainfall. January gets 20-50 mm of rainfall. The actual cropping pattern in this zone is B_4 G_4 W_4 BA_5 GU_5 RO_5. In this zone, groundnut caster, sarson crops can also be grown successfully. Bajra, gram and wheat are the main crops of the region covering 24·9, 22·3 and 12·5 per cent areas respectively. Barley, guar, rabi oilseeds and jowar cover 7·8, 5·5, 5·1 and 11·3 per cent areas respectively.

The area under F_3 (B_2 D_2) E_1 F_4 rainfall pattern has the cropping pattern as W_4 M_4 G_4 KF_4 RF_6. Wheat, maize, gram and kharif fodder are the main crops of the region covering 21·4, 18·9, 16·5 and 20·1 per cent areas respectively. Rabi pulses cover 4·9 per cent area. In this zone crops like groundnut, urd, barley and sarson can also be cropped successfully.

The next rainfall pattern is E_1 F_2 (B_2 C_1 D_1) E_2 F_3 indicating its suitability for crops like maize arhar, urd, groundnut, gram, barley, wheat etc under rainfed conditions. The actual cropping pattern in the zone is W_4 G_4 M_4 P_5 B_5 KF_4. Wheat, gram, maize and kharif fodder are the main crops covering 21·8, 17·5, 13·9, 16·1 per cent areas respectively. Paddy and bajra cover 8·3 and 7·4 per cent areas respectively.

TABLE 2

Amount of rainfall at various probability levels in the different parts of the State (mm)

Probability (per cent)	Region	Rainfall (mm)						
		June	July	August	September	January	February	March
80	1	12-20	75-150	125-150	20-45			
	2	0-2	30-70	60-100	2-20			
	3	5-7	15-40	30-50	0-10			
	4	5-11	40-75	50-125	5-15			
60	1	30-60	125-285	150-325	25-100	10-30	10-15	
	2	10-30	75-150	100-200	40-90	0-10	0-5	
	3	15-17	35-75	50-75	10-25	0-5	4-10	
	4	15-20	60-125	60-150	15-30	5-10	4-10	
40	1	50-90	200-342	160-400	70-200	20-60	15-28	10-25
	2	15-40	125-225	200-275	75-140	5-20	0-10	1-5
	3	25-40	60-115	80-115	20-50	10-20	10-12	3-10
	4	40-60	115-200	115-160	50-70	20	12-15	10
20	1	75-130	275-411	300-500	100-325	40-91	30-60	20-51
	2	30-75	200-290	180-280	125-200	10-25	20-30	1-7
	3	40-65	120-200	100-175	60-100	25-40	12-25	10-20
	4	65-75	200-275	175-300	100	40	25-30	20

1. Northeastern 2. Southeastern 3. Southwestern 4. Central region

The seventh and the last rainfall pattern is $E_1 F_2$ (A_2 C_1 D_1) $E_3 F_2$ with the cropping pattern of $M_1 G_4 W_4 P_5 S_5 GN_6 KP_6 KF_4$. Maize, gram and wheat crops cover 18·4, 18·2 and 17·8 per cent areas respectively in this zone. Paddy occupies 8·1 per cent area. Sugarcane, groundnut and kharif pulses cover 6·0, 3·1 and 4·9 per cent areas respectively. Jowar crop, mostly grown as kharif fodder, covers 11.3 per cent area in this zone. In this zone area under arhar, groundnut, urd and wheat can be increased.

6. Rainfall probabilities and crops

The first, second, third and fourth quintiles of rainfall indicate the amounts of rainfall at 80, 60, 40 and 20 per cent probability levels (Table 2).

(*i*) *Rainfall distribution at 80 per cent probability*— 75 to 150 mm of rainfall is received in northeastern (NE) region during each of the months July and August. Also in the southeastern (SE) and Central (C) regions 30 to 100 mm of rainfall is received in each of these months. June and September months receive very small amounts of rainfall all over the State. With this rainfall distribution, short duration crops like moong and moth etc can be successfully cultivated. Bajra, guar and gram can be grown in the NE and SE parts of the State where higher rainfall is received.

(*ii*) *Rainfall distribution at 60 per cent probability* — Southwest region receives 30 to 75 mm of rainfall per month in July and August, whereas June and September months receive very small amount of rainfall. In the NE region July and August receive 125 to 300 mm of rainfall per month and September gets 25-100 mm rainfall. In this region crops like maize, jowar, bajra, sarson, gram etc can be successfully grown. In SE parts of the State July, August and September receive 75–150, 100-200 and 40–90 mm of rainfall per month respectively. Bajra, jowar, guar, moong, the low water requirement crops, can only be tailored with the distribution of rainfall.

(*iii*) *Rainfall distribution at 40 per cent probability* — At this probability level in the NE region June, July, August and September receive 50-90, 200-342, 160-400, 70-200 mm of rainfall respectively. In such a rainfall pattern medium water requirement crops like maize, jowar, arhar urd, gram, sarson, and barley etc can be grown. With 20-60 mm of rainfall in January and 15-28 mm rainfall in February alongwith conserved moisture storage, the winter crops are grown successfully. In the SE region July, August and September receive 125-225; 200-275 and 75–140 mm of rainfall respectively which is sufficient for the crops like bajra, jowar, guar, raya

and gram crops. Southwest region receives the lowest rainfall in the State. The rainfall distribution in this zone is of the type 25-40 mm, 60-115 mm, 80-115 mm and 20-50 mm rainfall in June, July, August and September respectively. Here, low water requirement crops should be given more preference such as moong, moth, guar, bajra, cowpeas, taramira and raya etc. In the central parts of the State the rainfall pattern is 40-60 mm in June, 115-200 mm in July, 115-160 mm in August and 50-70 mm in September. This pattern of distribution is sufficient to meet the water requirement of crops like bajra, guar, cowpeas, raya and taramira etc.

(*iv*) *Rainfall distribution at 20 per cent probability* — In the northeast region, the rainfall pattern is 75-130 mm rainfall in June, 275-411 mm in July, 300-500 mm in August and 100-325 mm in September. With this rainfall pattern crops like maize, arhar, groundnut, urd, gram, sarson, barley etc can be successfully grown. In the southeast region the rainfall pattern is sufficient for crops like maize, jowar, bajra cowpeas, gram, raya etc.

Suitable water conservation and management practices are essential in these rainfed areas for better crop planning. In the southwestern region rainfall distribution in June, July, August and September months are as 40-65 mm, 120-200 mm 104-175 mm, 60-100 mm respectively. Here bajra, guar, moong, taramira crops can be well grown. In the central regions of the State the rainfall distribution is of the form as June receives 65-75 mm, July 200-275 mm, August 175-300 mm and September 100 mm rainfall. With this pattern of rainfall, bajra, jowar, cowpeas, raya, sarson and gram crops can be successfully grown. Crop planning should be according to the rainfall distribution and its appropriate probability level.

7. Conclusion

Haryana State has been demarcated into 7 rainfall zones with reference to the broad water requirement of various crops. The distribution of crops has been studied at block level in relation to the rainfall patterns. The cropping patterns under rainfed conditions in the various blocks indicate their variability with reference to the availability and variability of rainfall. The monthly rainfall probabilities indicate the confidence with which the existing cropping pattern should have the requisite flexibility.

REFERENCE

National Commission on Agriculture 1973 Rainfall zones and cropping pattern of Haryana.