

REFERENCES

1. Balasubrahmanyam, R. and Santhanam, V. (1951) Inheritance of *crinkled leaf*, a new abnormal mutant in Asiatic cotton. *Curr. Sci.* 20: 46.
2. Fisher, R. A. (1938) Statistical methods for research workers. Oliver and Boyd (1938).
3. Granhall, I. (1946) On heterosis effects in *Triticum vulgare*. *Hereditas* 32: 287-93.
4. Gustaffson, A. (1946) The effect of heterozygosity on viability and vigour. *Hereditas* 32: 263-86.
5. Gustaffson, A. (1947) The advantageous effect of deleterious mutations. *Hereditas* 33: 573-575.
6. Jones, D. F. (1945) Heterosis resulting from degenerative changes. *Genet.* 30: 527.
7. Karper, R. E. (1930) The effect of a single gene upon development in the heterozygote in Sorghum. *J. Hered.* 21: 187.
8. Ramusson, J. (1927) Genetically changed linkage values in *Pisum*. *Hereditas*. X:
9. Roberston, D. W. and Austin, W. W. (1935) The effect of one and of two seedling lethals in the heterozygous condition on barley development. *J. Agri. Res.* 51: 435.

<https://doi.org/10.29321/MAJ.10.A04368>

Rainfall in the Ceded Districts

By

SRI K. R. RAMASWAMY,
Assistant in Meteorology

SRI C. BALASUBRAMANIAN,
Agricultural Meteorologist, Coimbatore

Introduction: The districts of Anantapur, Bellary, Cuddapah and Kurnool form the zone known as the "Ceded Districts" in the Madras State. This zone is a typical dry-farming tract. Barring a few pockets of garden-lands, the major portion of the area under cultivation in these four districts is rainfed. Hence the nature of precipitation decides the success or failure of farming in this tract. The tract is situated between longitude $3^{\circ} 4'$ to $16^{\circ} 25'$ and latitude $75^{\circ} 40'$ to $79^{\circ} 33'$ and at an altitude that varies from 500 to 2500 feet. Bellary and Anantapur form the northern and North-Eastern extremity of the Mysore plateau and Kurnool and Cuddapah touch the East coast districts of Nellore and Guntur.

Climate of this Zone: The average annual rainfall in this zone varies from 22" to 28 inches, spread over a period of 45 to 65 days. This tract experiences extremes of temperature; the mean maximum temperature ranging from 84° to 104° F. and the minimum temperature from 62° to 80° F. In summer the maximum temperature goes up to 114° F and in winter the lowest minimum temperature is even 44° F. The humidity is also comparatively low, with a mean range of 55 per cent to 79 per cent. Another feature of the tract is that a year of good rains is invariably followed by two or three years of scarcity.

Soils: In Kurnool the soil is red with different grades of fertility and with patches of black cotton soil on the western portion where it touches the Bellary district. Bellary with its numerous detached rocky hills has got stretches of black cotton soil with a general slope from west to east. The district of Anantapur has arid red soils of poor fertility and deficient rainfall; treelessness and general poverty of the soil are the chief features of this district. Cuddapah may be regarded as an oasis in this zone, in that the soil is quite fertile, being covered by the river Pennar and its tributaries.

Material and Methods: The rainfall of this tract is considered in all its aspects, as the entire agriculture in this tract depends on its rainfall. The data were collected for a period of 81 years from 1870 to 1950, both inclusive, from the "Season and Crop Reports", published by the Board of Revenue, and were analysed statistically.

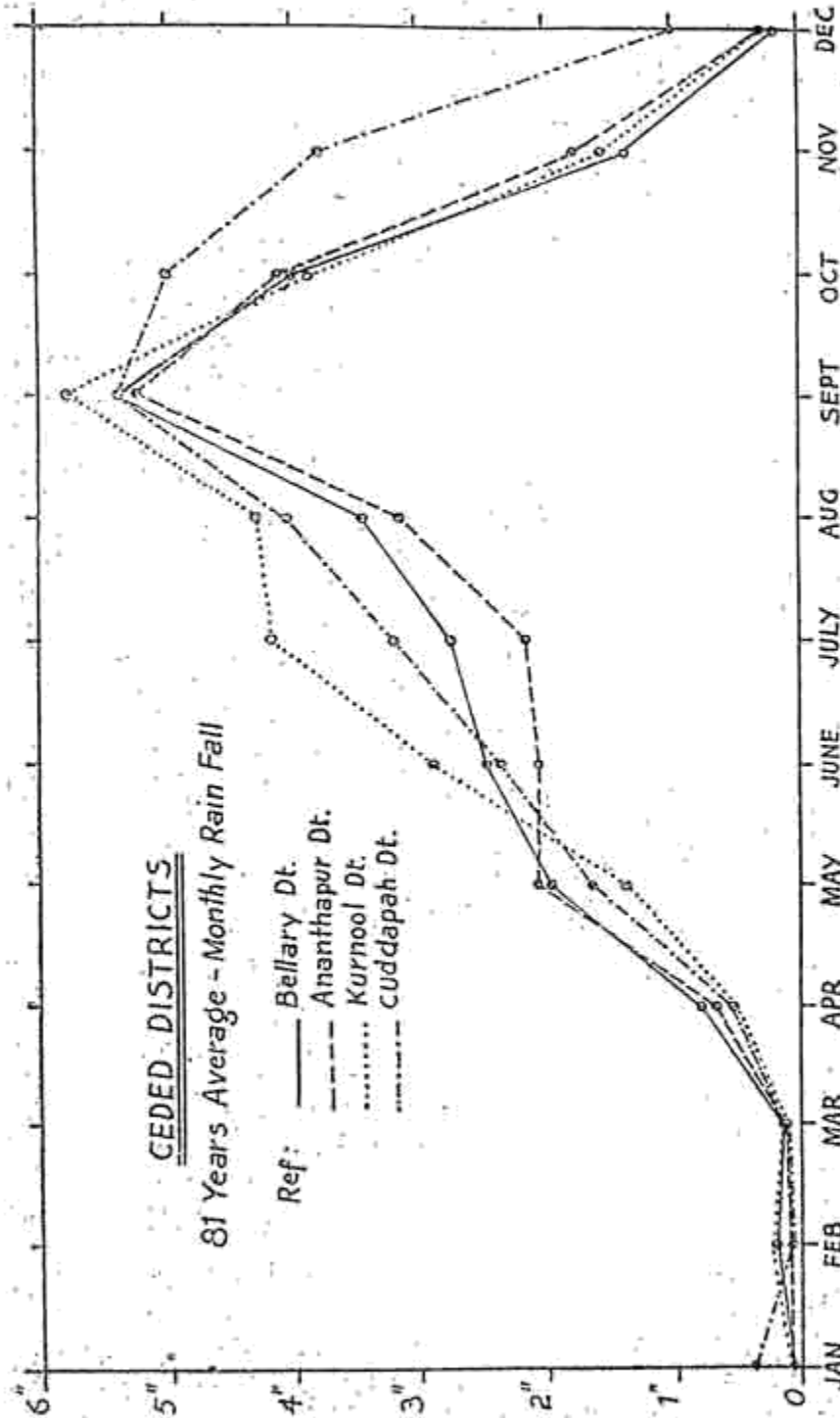
Justification for Considering the Four Districts as One Unit: A study of the graph drawn with eighty-one sets of total annual precipitation for these four districts will reveal that the variations are well defined, barring the periods 1880—1890 and 1940—1950.* In regard to the latter period, 1940—1950, it may be stated that the variation is very wide not only in these districts but in the Madras State as a whole.

In regard to the intensity of seasonal showers it may be inferred from the data that it is similar in all the four districts. In September and October it is high, except in Kurnool and soil erosion is likely to occur.

Statistical Analysis: In Table II particulars are given regarding the monthly distribution of the annual precipitation with the number of rainy days in each month and the percentage of drought years.

Characteristics of Monthly Precipitation: The data are also graphically represented to bring out the inter-relations among the monthly precipitations of the four districts. To find out the nature of fluctuations and deviations of the monthly precipitation between the periods of ten years, the 81 years' rainfall data have been considered in eight units; (10 years data for one unit) and four graphs drawn, one for each district. From the graphs, it can be concluded (1) that September is the wettest month in the year; (2) More variations and fluctuations are seen between August and October and (3) in all the four districts the dry season remains unchanged.

To get an idea of the inter-relationship between the monthly precipitations, 66 inter-monthly correlations were worked out for each of these four districts. The number of positive and significant inter-monthly correlations are five for Kurnool district, three for Cuddapah, two for Anantapur and one for Bellary. But it is interesting



to note that the correlation existing between the precipitation in the months of June and October is positive and significant in every one of these four districts. So it can be concluded that if the precipitation in June is normal in any one year, the ryots of this zone irrespective of the

district to which they belong, can hope to have normal rains in October of that year. Normal rains in October in this tract means a favourable agricultural season for the year as a whole.

Likewise, the total seasonal precipitations have also been considered apportioning the seasons as :

Summer :	February to May.
South-West Monsoon :	June to August.
North-East Monsoon :	September to January, of next year.

Though September is generally included in the South-West monsoon period, a deviation has been effected in regard to the present data, since September happens to be the transition period. Further, agriculturally, September is an important month when the major portion of sowings are done, if the rains are favourable. There is nothing special regarding the relationship between the seasonal showers except the positive significant correlation between South-West monsoon and the North-East monsoon showers in Kurnool. This sort of weak and insignificant relationship of varying nature is perhaps the justification for the fear in the minds of the farmers of the tract that the season in the zone is very unreliable. But one noteworthy feature is that the rains received in the months of September and October have a positive significant relation with the total annual precipitation in every one of the four districts. The November rainfall also is similarly related, except in Kurnool. This finding is in conformity with the local agricultural practice. In fact September and October form the main sowing season in the tract. If the rains are very late and disappointing, sowings may be done even in November. Rains received in each of these three months have been found to be positively and significantly correlated with the total annual precipitation. If rains in these three months are normal, the year as a whole is likely to be a prosperous one for the tiller of the soil.

Receding of Monsons: There is a general complaint in this tract that the monsoon is becoming weak year by year. To know whether the data on hand support this belief, the period of 81 years was divided into spans of ten years, the first one being for the period of 11 years. Ten years' duration is taken as one span length. For the sake of brevity only the annual rainfall data are presented in Table III.

It is interesting to note that isolated heavy falls that go to enhance the total precipitation in certain years will not make all the years in that span similar. Further, the monsoons are not receding and becoming weak year by year. The fluctuations noted, have been in existence for the past many years. Besides, even in the recent years 1947-50 the rainfall variation in this zone was not so very marked as in other parts of the State.

Floods and Droughts: Because of the uncertain nature of the agriculturally important North-East monsoon in this tract, the possibility of floods and droughts was worked out on the lines adopted by Ramdas

(3). According to him, a year is to be considered as one of 'Floods' or 'Drought', if the deviation of the actual rainfall in that year is more than or less than twice the mean deviation. The data have been analysed on this principle and presented in Table IV.

The number of floods and droughts are too few to draw any definite conclusions regarding the periodicity of occurrence. The first flood in 1874 was followed by a drought in 1876 in all the four districts. In the remaining years even though there is no regular occurrence of either flood or drought in the four districts, there is a tendency that when one or two districts are experiencing either flood or drought, the rainfall in other districts tend to approach the flood or drought stage, except in 1904 and 1933.

But a perusal of the "Season and Crop Reports" indicates that the remission of kist in these districts either in some taluks or even the district as a whole, had been more frequently granted than could be actually justified by the particulars given in Table IV. But the distribution of the rainfall in such years might have been very unfavourable, particularly during the critical periods of cropping and also during the months of September to November, justifying such remissions on the whole.

Conclusions : (i) The four districts of Anantapur, Bellary, Cuddapah and Kurnool can be considered as one unit for any analysis of the rainfall data in view of the similarities of seasonal conditions.

(ii) If the rainfall in June in any one year is normal, it is an indication that the rainfall in October in that year will also be normal and a prosperous one for the farmers.

(iii) The general feeling that the rainfall is unreliable in this zone is supported by weak correlations existing among the various seasonal showers in the tract.

(iv) If the rains in September and October of any year are normal, it is an indication that that year will be a prosperous agricultural year. Manifestly these have no influence on the precipitations of the succeeding year.

(v) It is noted that the monsoon is not receding in this tract. Geographically it is so situated that in both the monsoons only the residual effects are felt and as such a general feeling of unreliability is inevitable, with frequent partial failures of rains, as the tract is mainly dependent on its seasonal rain fall for its cropping practices.

(vi) The data in a way support the belief that a year of plenty is followed by two or three years of scarcity. But there appears to be more of flood years than years of drought. This is perhaps the

reason why soil erosion is a serious problem in the tract, particularly in the Bellary district, which has a general slope of the soil from west to east.

Acknowledgment: The authors are grateful to Sri M. B. V. Narasinga Rao, Paddy Specialist, for his very valuable help and guidance in the preparation of the paper. Their thanks are also due to Kumari T. P. Anna, for help in the computation of the data and to all those responsible for the collection of the data forming the basic material for this paper.

BIBLIOGRAPHY

1. Narasinga Rao, M. B. V. and Balasubramanian, C. (1949) Forty-two years rainfall data collected in the observatory attached to the Agricultural College and Research Institute, Coimbatore. *The Indian Geographical Journal*, Vol. No. XXIV. No.
2. Ramdas, L. A., (Dr.) (1950) Rainfall and Agriculture - *Indian Journal of Meteorology and Geophysics*. Vol. I. No. 4.
3. Ramdas, L.A., (Dr.) et al (1950) Is the Monsoon Receding? - *The Farmer*. Vol. I. No. 8.
4. Statistical Atlas of the Madras Presidency. Government of Madras.

TABLE I.
Rainfall in the Ceded districts

S. No.	Particulars	Anantapur	Bellary	Cuddapah	Kurnool
1.	Total annual rainfall with number of rainy days.	22.3" 37	22.9" 40	26.8" 41	25.7" 41
2.	Summer Showers (Feb.-May) with number of rainy days and % of the total precipitation.	3.2" 5 14	3.1" 6 14	2.6" 3 10	2.4" 4 10
3.	South - west Monsoon (June-August) with same particulars as for summer showers.	7.6" 14 34	8.8" 18 38	9.7 17 36	11.4" 21 44
4.	North-east Monsoon (September-January) with same particulars as for summer showers.	11.6" 18 52	11.0" 16 48	14.5" 21 54	11.7" 16 46

Note:—Number of rainy days is the average of the period (1870-1937).

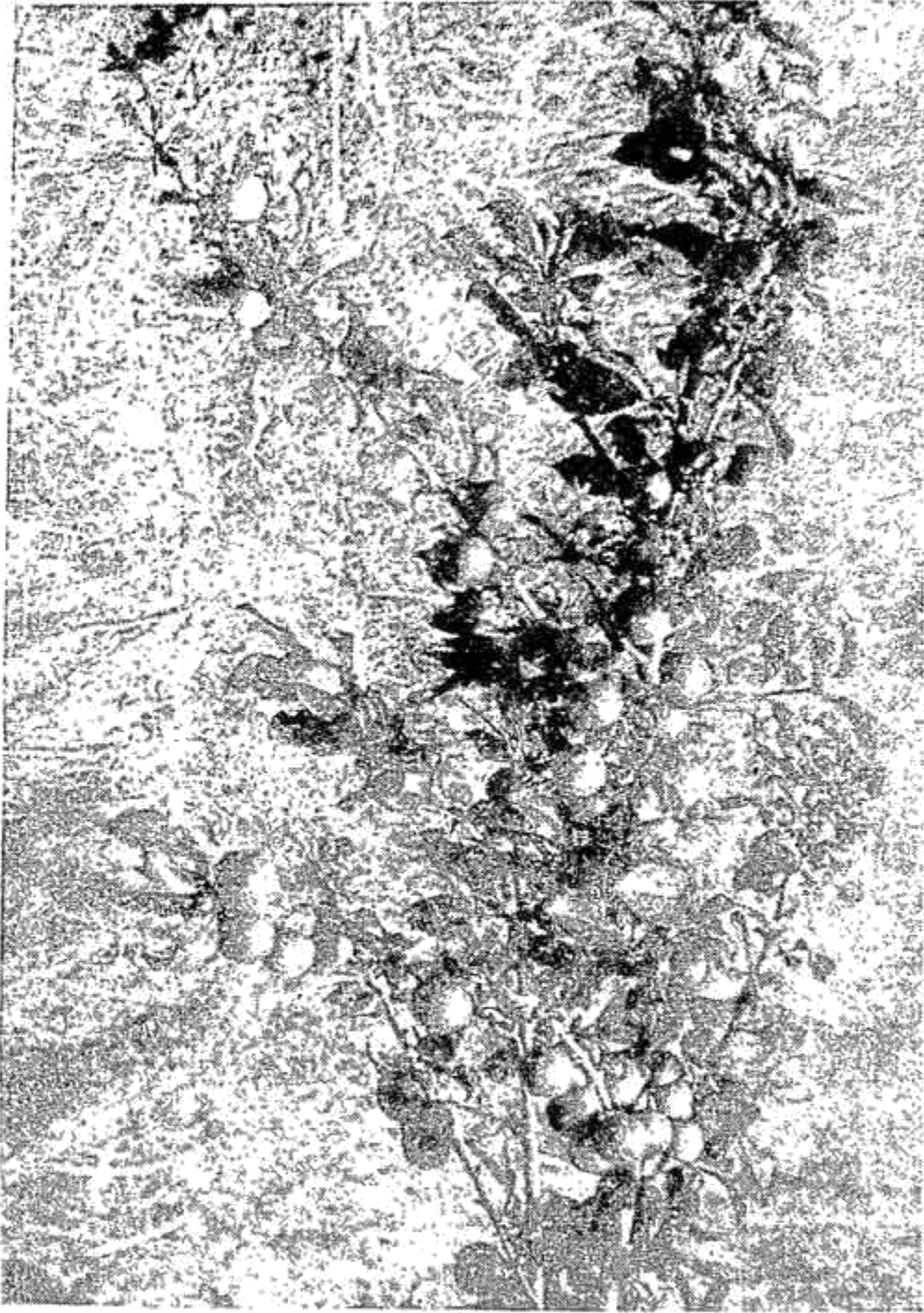
TABLE II
Monthly precipitation in the Ceded districts (81 Years' Data).

S. No.	Month	Anantapur		Bellary		Cuddapah		Kurnool	
		Mean Range in inches	No. of rainy days	Mean Range in inches	No. of rainy days	Mean Range in inches	No. of rainy days	Mean Range in inches	No. of rainy days
1.	January	0.1" to 1.6"	65	0.1" to 0.8"	...	0.4" to 0.5"	...	0.1" to 0.9"	67
2.	February	0.1" to 3.2"	72	0.2" to 2.2"	...	0.1" to 2.0"	...	0.2" to 2.2"	68
3.	March	0.2" to 1.6"	52	0.2" to 2.1"	...	0.2" to 3.2"	...	0.2" to 3.1"	49
4.	April	0.7" to 3.4"	5	0.8" to 2.6"	2	0.6" to 3.5"	1	0.6" to 2.3"	7
5.	May	2.1" to 8.2"	4	2.0" to 6.2"	4	1.7" to 9.0"	2	1.4" to 4.9"	1
6.	June	2.1" to 6.6"	4	2.5" to 6.5"	5	2.4" to 7.2"	4	2.9" to 6.1"	...
7.	July	2.2" to 8.4"	5	2.8" to 7.0"	6	3.2" to 8.9"	6	4.2" to 9.2"	...
8.	August	3.2" to 12.9"	5	3.5" to 9.1"	7	4.1" to 12.4"	7	4.3" to 12.2"	...
9.	September	5.3" to 13.0"	8	5.4" to 14.5"	8	5.4" to 17.0"	7	5.8" to 20.1"	...
10.	October	4.1" to 11.5"	6	4.0" to 11.6"	6	5.0" to 12.2"	7	4.0" to 15.7"	1
11.	November	1.3" to 8.0"	3	1.4" to 5.6"	2	3.8" to 13.4"	5	1.7" to 7.2"	10
12.	December	0.3" to 3.9"	1	0.2" to 1.8"	...	1.0" to 7.2"	2	0.3" to 4.8"	58

TABLE III
Ten-year normal rainfall in the Ceded Districts

S. No.	Details of the period considered	Ceded districts as a whole.			Ananthapur			Bollary			Cuddapah			Kurnool		
		Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	Mean for the period in inches	Number of years above or below normal	
1.	1870 to 1950 (81)	24.7	38/43	22.3	38/43	22.9	37/44	27.8	37/44	25.7	33/48					
2.	1870 to 1880 (11)	26.3	4/7	25.4	4/7	23.5	5/6	28.3	5/6	27.5	4/7					
3.	1881 to 1890 (10)	25.4	4/6	21.2	5/5	21.9	6/4	30.2	4/6	26.8	5/5					
4.	1891 to 1900 (10)	23.3	5/5	20.9	6/4	22.2	6/4	25.4	5/5	24.2	6/4					
5.	1901 to 1910 (10)	25.0	5/5	22.7	4/6	22.9	5/5	28.5	5/5	25.1	3/7					
6.	1911 to 1920 (10)	25.8	5/5	23.7	5/5	24.6	5/5	28.4	5/5	26.4	4/6					
7.	1921 to 1930 (10)	23.3	6/4	21.4	5/5	21.6	6/4	27.2	4/6	22.7	4/6					
8.	1931 to 1940 (10)	24.7	4/6	22.3	4/6	24.5	4/6	26.3	5/5	25.7	4/6					
9.	1941 to 1950 (10)	23.9	5/5	19.5	4/6	21.7	5/5	28.1	5/5	26.9	5/5					

Note.—Numerator indicates the number of years above normal. Denominator indicates the number of years below normal.



Offseason Bearing in plums, and unusual Phenomenon
at the Agricultural Research Station, Nanjanad.

TABLE IV
Floods and droughts in the Ceded districts.

Year	Bollary		Anantapur		Cuddapah		Kurnool	
	Mean Rainfall		Mean Rainfall		Mean Rainfall		Mean Rainfall	
	Flood	Drought	Flood	Drought	Flood	Drought	Flood	Drought
	34.2"	11.8"	34.6"	10.2"	42.1"	13.3"	39.8"	11.4"
1874	F		F		F		F	
1870		D		D		D		D
1878	27.5"		F		38.0"		F	
1891		D		10.8"		14.8"		14.0"
1903	30.5"		32.7"		F		34.7"	
1904		18.8"		17.9"		D		16.2"
1916	F		33.5"		40.1"		F	
1917	F		32.8"		38.1"		31.5"	
1933	F		26.4"		23.4"		27.8"	

Note:— 'F' Indicates flood year.
'D' Indicates drought year

Research Note

Offseason Bearing in Plums, and Unusual Phenomenon at the Agricultural Research Station, Nanjanad

At the Agricultural Research Station, Nanjanad, an area of about twenty-five cents of uncultivated waste land was cleared and terraced, and varieties of fruit plants consisting of plums, apples, peaches and pears of different varieties were planted in October, 1941. Four kinds of plums, viz., Shiro, Hale, Rubio and Gaviota formed part of the collection.

The normal fruiting season for these plants on the Nilgiris is May-June. During winter, the trees remain dormant and the growth stays arrested.

In the winter (November-December) of the year, 1950, two of the varieties, Rubio and Hale, flowered and developed stray fruits. This phenomenon was repeated in December, 1951, and a fairly sizable crop of fruits, averaging 300 per plant, was obtained. This unusual feature had not been observed before in any other part of the Nilgiris, so far as the writers are aware.

The plants received some attention in July 1951, by way of pruning off the dried branches. Whether the good bearing had any relation to this operation cannot be confirmed. But the fact that the plants set fruits during the preceding winter also suggests that fruiting was not due to this.

Steps are being taken to plant as much area as possible to plums, for further studies on this off-season bearing habit and on the influence of seasons and pruning practices on yield. The accompanying photograph of branches in fruit taken in December 1951 show the bearing at that time.

K. SAPTHARISHI.
M. D. AZARJAH.