https://doi.org/10.29321/MAJ.10.A01427



# Rainfall and Karunganni Cotton-Yields at Kovilpatti.

By

V. Ramanathan.

*Asst. Cotton Specialist, Kovilpatti.*

It is a matter of common knowledge that the yields of rainfed crops is a mathematical function of the rainfall. The potency of rainfall varies, on the one hand, not only with its magnitude and distribution, but also with the nature of the inter-relation between these two features and on the other, with the stage of plant growth at the time of its incidence and with the condition and the nature of the soil. In a plant like cotton, the growing and fruiting phases of which extend over a long period, the effects of rainfall are made more complicated, and any attempt to dis-entangle this knotty complex will only be in the nature of crude approximations as many of the individual and combined reactions are still unknown. Yet, it is quite essential on the part of the plant-breeder and the agriculturist to know, in a broad outline at least, the behaviour of the plant under various weather conditions and the critical periods at which the rainfall will have the best or the worst effects. This will enable the breeder to evolve a type which will have the best fit between the rainfall conditions prevailing in a locality and the plant, or to seek means to accelerate or retard the growth in such a way that the prejudicial effects may be mitigated, if not averted. Thus, if he has a knowledge that a heavy rainfall in the seventh fornight after sowing depresses the yield and if the rainfall records of that locality show that the rains are normal at that period, he can reduce the ill-effects by sowing the plants wider and thus induce in the crop a late maturity or by evolving a late strain. Such a knowledge will also enable him to say more accurately whether a crop could be introduced in a locality of a given distribution of rainfall and if so, which sowing period would give the optimum conditions for getting a normal yield. Such useful details are not now available and very many ideas now held are mostly vague and unauthenticated. It is proposed, in

this note, to review with the above purpose, the behaviour of karunganni cotton grown during the last twenty-one years at the Kovilpatti Agricultural Station.

It may be mentioned, at the outset, that on this Station, crops have been raised on a systematic four-year-course rotation, cotton,–cumbu,–cotton and fodder cholam-so that there are two sets of cotton yield figures according to the previous crop. This classification is extremely essential for the proper evaluation of the rainfall effects as it has been found that cotton after cumbu gives on an average 50 lb or 15 % of kapas per acre more than that after cholam. It is not definitely known how this differentiation is brought about, but it may be noted that on this farm, all the cumbu crops have been manured with farm yard manure, the cotton, barring the last two years, by sheep penning and the fodder with some organic manure like fish manure, ground-nut cake or by penning sheep.

With regard to the data worked out in this paper, those for the average yields of kapas for the entire farm obtained up to the 16th May of each year were taken irrespective of the types of cotton grown and of the variation in the soil fertility. In the case of rainfall, the mean sowing dates of cotton were fixed as the basis, in each year, from the data given in the cultivation sheets. Two fortnightly groupings of rainfall prior to, and ten fortnightly groupings after, this date were made for each year. In the aggregate amounts of fortnightly rainfall, all precipitations below 15 cents and above 2 inches recorded in a day were not taken into consideration, as the former would, in all probability, be of no consequence to the plant and as anything above 2 inches would be likely to go away as run off and would not be available to the plant in the latter case. It is true that this method of discarding figures is quite arbitrary. But, some line had to be drawn some where to allow for the two known facts and, in the absence of exact information, this procedure was adopted.

The commonly used method in the determination of relationships between any two variables is the working out of the correlation coefficients, but, as the frequency curves of the distributions of rainfall are not normal, its application

will be of doubtful value. The one followed here is to classify the rainfall data in each fortnight into three groups, viz., (1) with no rainfall, (2) with a rainfall below 2.5 inches, and (3) with a rainfall above 2.5 inches, to work out the average yields of cotton in all such years and then compare them. Statement I gives the details thus obtained.

Statement I.

Seed cotton yields in lbs. per acre.

1. After cumbu.

| Rainfall in inches. | Fortnights to sowing. | | Fortnights after sowing. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Nil. | 300 | – | 396 | 431 | 426 | 319 | 369 | 383 | 396 | 359 | 364 | 356 |
| | (3) | – | (4) | (7) | (7) | (7) | (10) | (12) | (12) | (15) | (16) | (9) |
| Below | 371 | 399 | 435 | 349 | 337 | 397 | 382 | 365 | 407 | 411 | 356 | 385 |
| 2.5" | (15) | (3) | (4) | (5) | (8) | (11) | (10) | (7) | (6) | (6) | (4) | (10) |
| 2.5" & | 461 | 369 | 348 | 343 | 362 | 418 | 330 | 347 | 218 | – | 592 | 393 |
| above | (3) | (18) | (13) | (9) | (6) | (3) | (1) | (2) | (3) | – | (1) | (2) |

2. After fodder.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nil. | 294 | – | 322 | 350 | 368 | 284 | 345 | 329 | 350 | 321 | 323 | 289 |
| | (3) | – | (4) | (7) | (7) | (7) | (10) | (12) | (12) | (15) | (16) | (9) |
| Below | 327 | 314 | 327 | 306 | 295 | 340 | 305 | 326 | 320 | 333 | 330 | 343 |
| 2.5" | (15) | (3) | (4) | (5) | (8) | (11) | (10) | (7) | (6) | (6) | (4) | (10) |
| 2.5" & | 342 | 326 | 325 | 315 | 313 | 362 | 314 | 289 | 230 | – | 329 | 394 |
| above | (3) | (18) | (13) | (9) | (6) | (3) | (1) | (2) | (3) | – | (1) | (2) |

(Remarks.—Figs: within brackets indicate the number of years tried.)

The above statement discloses the following facts :—

1. That in cottons grown after cumbu, the optimum conditions for a good yield are that

(a) there should be good rainfall during the two fortnights preceding the dates of sowing and during the fourth, eighth and the tenth fortnights after sowing,

(b) a moderate rainfall between one to two inches during the first fortnight after sowing is welcome,

(c) no rains in the second and the third fortnights following the sowings will be beneficial,

(d) complete drought or light rainfall in the seventh fortnight will increase the yield but a heavy rainfall considerably reduces it &

(e) it is immaterial if the fifth and sixth fortnights are dry or rainy.

2. In the case of cottons after fodder, the above inferences are generally valid barring differences (Vide Statement II.)

(a) Good precipitation or its absence in the first and eighth fortnights does not affect the yield &

(b) rainfall in the fifth fortnight depresses the yields.

Statement II.

Percentage of increase or decrease over 'no rains' in the fortnight.

| After | Fortnights prior to sowing | Fortnights after sowing. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Cumbu | +28.7 | | −7.1 | −20.0 | −18.5 | +25.7 | + 2.2 | −5.7 | −13.1 | +14.5 | +10.7 | + 8.7 |
| Fodder | +12.2 | | +0.9 | −10.9 | −17.7 | +21.5 | −11.3 | −3.3 | −17.1 | + 3.7 | + 2.2 | +21.5 |

(N. B. + or-, respectively, indicate that there is an increase or decrease in the yields over those obtained in the respective weeks when there is no rain.)

Another inference which follows from statement II, is that rains in excess or at inopportune periods do not affect the cottons after cholam so much as they do those after cumbu. In other words, if rains are well distributed, cotton after cumbu yields better and if badly distributed, it suffers more than cotton after fodder cholam.

Again, rainfall influences remarkably the ginning percentage, a commercially important factor in the yield of cotton. The discussion on this aspect of the yield problem will be postponed to another occasion.

Before concluding, it must be pointed out that, in the results obtained above, there are, besides the ignorance about the effective component of rainfall, certain limitations which should not be lost sight of. Firstly, the paucity of the data is a serious handicap in the applicability of this result for the purpose of working out a prediction formula. It is not known if the rainfall of these twenty-one years would form a random sample of the rainfall at Kovilpatti. It is often noticed in many places that the rainfall distribution is not fortuitous when a large number of years is taken into consideration. Mr. S. M. Jacob, I. C. S., has shown that in certain centres in the Punjab, the rainfall distribution takes the form of a sine or a double sine curve. Unfortunately, data are not available to work out the shape of the curve at Kovilpatti. Secondly, there is always a correlation between the precipitations in the consecutive or alternate or even in the several months of the year and the yield is only the resultant of diverse effects produced by them, individually and conjointly. Therefore, the relation worked between the yields and the rainfall in short periods must be interpreted with caution. It is only by properly assessing the influence, by a multiple correlation method, a reliable prediction formula will be obtained.

The available information goes to show that for a maximum yield of karunganni cotton, the following weather conditions must prevail.

1. There must be heavy rainfall in the two fortnights preceding the sowing followed by a light shower of one to two inches in the first fortnight after sowing.
2. A dry spell must be experienced during the second and the third fortnights followed by good showers in the fourth, after sowing.
3. Another dry spell in the fifth, sixth and the seventh fortnights—especially, the dry seventh fortnight is highly important—is extremely beneficial.
4. The eighth, ninth and the tenth fortnights after sowing should have fairly good showers.

Most of the above conclusions are confirmed by the ryots' experiences.