CONDITIONS DETERMINING THE AREA SOWN WITH COTTON IN THE UNITED PROVINCES.

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IN years when local supplies of cotton fall short of the demand, I am frequently asked by merchants and manufacturers why larger parts of the provinces do not grow cotton, and why the cotton-growing tracts do not put down a larger area. The answers to both questions are of some interest not only to those engaged in the cotton industry, but to students of the agriculture of the provinces. I propose to examine them in the light of the statistics which are available since 1860.

A word of explanation is necessary as to the meaning of the area figures used in this note. In the old returns the area recorded as sown with cotton is the sum of the areas of all fields on which cotton was grown, either as a sole crop or mixed with other staples. For some years past, however, the published figures attempt to deduct the area occupied by other crops mixed with cotton: thus, if 20 acres are reported to be sown with cotton mixed with *arhar*, only 16 acres will be shown in the returns as sown with cotton, the remaining four acres being entered under *arhar*. Opinions differ as to the advantages of this procedure, but the question need not be discussed here it is sufficient to point out that materials do not exist which would render possible a reduction of the older figures to the newer system, so that it is necessary to adhere to the older system throughout, in order that the figures given may be comparable. All the area figures given in this paper represent, therefore, the total area of the fields on which cotton was sown, whether as a pure or as a mixed crop. It may be added that the figures given take no account of the small area sown with cotton in Oudh, as statistics for the Oudh districts are not available for the earlier portion of the period under review.

The distribution of the cotton area in the provinces can be seen from this table :—

TABLE I.

Distribution of the Cotton area in the Province of Agra.

Tract.			Percentage of total area sown in			
			1865.	1870.	1900.	1904.
Meerut and Agra divisions	...	...	45	50	58	67
Allahabad division	...	...	35	33	30	23
Total cotton tracts	...	...	80	83	88	90
Rohilkhand	...	...	16	14	11	9
Rest of province	...	...	4	3	1	1
Total non-cotton tracts	...	...	20	17	12	10

There are two well-defined cotton tracts, the upper and middle *duab*, containing the Agra and Meerut divisions, and the Allahabad division which includes both the lower *duab* and the country south of the Jumna known as Bundelkhand. The table shows that the percentage of the whole cotton area which lies in the cotton tracts has risen during the period under consideration from 80 to 90 ; the proportion is really perhaps slightly higher, as in 1904 (the last year given in the table) there were special hindrances to sowing in Bundelkhand. It will be seen then that the tendency is to confine the cotton area within certain tracts. This tendency is seen in the case of some other crops also, notably sugarcane, and it finds a ready explanation in the development of trade and communications which has been so marked during the period under review. At its commencement railways were rare and trade was still carried mostly on the rivers, while large areas were landlocked. Cotton was then grown to a small extent all over the country for consumption in the villages, even when local conditions were unfavourable to the crop : this still occurs, but more and more people whose climate or soil is not well adapted to cotton are taking to purchase the supplies which they need, and which the railways bring within their reach. There is every reason to suppose that this process of concentration will continue, and that the production in the submontane and eastern districts, already trifling, will still further diminish. It appears to be possible that if prices are maintained at a certain level, the cotton-tract may extend some distance northward across the Ganges, that is in south Rohilkhand and in a portion of south Oudh ; but no increased production can be expected in the future from the bulk of the area classed in Table I as non-cotton tracts,

unless the level of prices should be permanently raised by a substantial amount.

Apart from the conditions of soil and climate, there is an artificial factor that tends to confine the growth of cotton to certain definite tracts. It is generally recognised that the shortness of the growing season is a serious handicap to cotton growers in these provinces : this evil can be met to some extent by sowing with irrigation before the rains break, a practice that has other advantages also, for if the plants get a good start they may escape injury from the heavy rain that is usually received in July. while the prolongation of the tillage season, enables the cultivator to do greater justice to all his land alike. But the irrigation must come from canals ; lifting water from wells in May and June is ruinous to the cattle employed. and the rapidity of evaporation makes the practice unprofitable, if not impracticable. in all ordinary cases. Now, the *duab*, the chief cotton-tract, is very copiously provided with canal water, and here the practice of early sowing is spreading rapidly, while the recent reduction* in the water-rates charged on this crop, will undoubtedly accelerate this most desirable development in agricultural practice. In the other cotton-tract. Bundelkhand. canal water is not yet available in the sowing season. but it is hoped that the works now in progress will suffice to provide a supply in a few years' time. and then early sowing. and probably the total area, may be expected to increase. The canals thus give a differential advantage to the cotton-grower whose land lies within their scope, and this advantage must gradually tell on the distribution of the area.

The considerations that determine the area sown in the cotton-tracts in any year are, perhaps, more complex than those which govern the distribution of the crop over the provinces as a whole. The area is governed by the action of a very large number of individuals, not very well informed, and somewhat exposed to the influence of fashion and of prejudice. It is not, therefore, to be expected that every variation from year to year can be explained by facts on the official record. At the same time it is possible to state with some approach to precision, the main motives that govern the action of the individual cultivator, and even to measure by statistics the variations in weight of these motives in different years.

When a cultivator sets to work to plan out his autumn campaign, his first object is to provide enough food to carry his family and his labourers over to the next harvest, and perhaps a little beyond ; therefore the area that he will devote to crops intended for the market. will depend mainly on the

* With effect from 1905 the water-rates on cotton have been reduced by one-third throughout the cotton-tract.—W. H. M.

stock of food within his reach at the time of sowing. Now, putting aside the special cases of individuals, it is fair to say that the condition of the mass of the cultivators in this respect can be generalised ; in some years they have much more food than others, so that a rough measure of the areas that will be devoted to crops for the market in any tract can be obtained from a record of the food-stocks available in the tract at sowing time. There is no more hopeless problem in Indian statistics than to determine actual food-stocks, but fortunately this is unnecessary for our present purpose : it is sufficient if we can discover an index to fluctuations in stocks, without reference to their actual amount, and such an index lies ready to hand in the price of wheat prevailing in local markets. It is well known that in Upper India the prices of all food-grains taken together follow the price of wheat, so that if price-curves are plotted, the shape of the wheat-curve is almost exactly similar to that of the curve for all other grains. It follows that the wheat-curve can safely be used, except, perhaps, in seasons of acute distress, as a guide to fluctuations in food-stocks.

But this is not the whole question. Having measured the motives that determine the area of crops for the market, we have still to measure those that govern the sowing of cotton rather than of some other market crop. There are of course large numbers of cultivators who will sow cotton in almost any circumstances, but the area they sow will depend to some extent on the return expected, while there are also large numbers who will sow cotton only if they think it will pay them better than other crops. Thus the main motive is measured not so much by the price of cotton as by the ratio between the price of cotton and that of other market crops. The ordinary cultivator is not able to look far ahead, and so far as we can discover he is guided largely by the prices prevailing at the time he is planning his campaign, that is, by the prices of the last preceding crop ; but he has a good memory, and the after-effects of a period of high profits or of losses can be observed for a long succession of years.

If then the sowing season itself were not liable to fluctuations, we might expect that it would be possible to trace a fairly close connection between the area sown and the ratio of cotton-prices to prices of other produce ; but unfortunately the question is complicated by accidents of season. It has been pointed out above that the growing season in these provinces is really too short for cotton ; if, therefore, anything happens to interfere with the sowing of cotton at the beginning of the season, the cultivator revises his plans and sows some crop that will succeed when sown later. This fact is very clearly established by a long series of statistics ; whenever the rains are late, or whenever they are so continuous at the start as to retard sowings, the

proportion of cotton to other autumn crops falls materially, so that it is always safe to estimate that if the rains are not established by the beginning of July, the cotton area will be lower than would otherwise be the case.

The evidence on which the foregoing remarks are based is summarised in the next table : —

TABLE II.

Area sown with cotton in the last 44 years, with ratios of cotton prices to wheat prices.

Year.			Ratio. of prices.	Area (thousands of acres).	Year.			Ratio. of prices.	Area (thousands of acres).
1861	...	...	79	953	1883	...	...	86	1,622
1862	...	...	127	986	1884	...	...	117	1,570
1863	...	...	417	1,136	1885	...	...	134	1,576
1864	...	...	333	1,740	1886	..	...	122	1,790
1865	...	...	92	895	1887	...	...	80	1,445
1866	..	...	128	1,103	1888	..	...	100	1,342
1867	...	...	93	947	1889	...	...	110	1,577
1868	...	...	...	865	1890	...	...	93	1,519
1869	...	...	107	1,152	1891	...	...	96	1,196
1870	...	...	159	1,248	1892	...	...	100	998
1871	...	...	148	1,072	1893	...	...	102	1,266
1872	...	...	109	1,266	1894	...	...	124	1,444
1873	...	...	85	980	1895	...	...	107	1,261
1874	...	...	122	1,092	1896	...	...	86	1,370
1875	...	...	172	1,056	1897	...	...	53	1,079
1876	...	...	191	1,186	1898	...	...	74	1,102
1877	...	...	123	718	1899	...	...	81	1,168
1878	...	...	122	1,316	1900	...	...	72	1,228
1879	...	...	86	1,240	1901	...	...	68	1,361
1880	...	...	126	1,378	1902	...	...	90	1,463
1881	...	...	127	1,594	1903	..	..	97	995
1882	...	...	96	1,642	1904	...	...	152	1,401

This table shows for the last forty-four years the area sown with cotton and the ratio which the price of an acre of cotton bore to an acre of wheat in the sowing season of each year ; the ratio is calculated by taking the market prices at Cawnpore of cotton and of wheat, and applying them to the "normal" outturn per acre, the term "normal" denoting the outturn that the cultivator expects to get and that influences his calculations. It will be seen that this ratio is calculated to measure the resultant of the two principal motives that influence the cultivator in regard to sowing cotton. If food-stocks are large, the price of wheat is low, and the ratio of cotton to wheat is high ; while if food-stocks are low, the price of wheat is high, and the ratio of cotton to wheat is low, even though cotton prices may themselves be higher. Similarly, if the price of wheat is high, the cultivator who has food on hand will be inclined to sow wheat or some other food-crop as a market crop, while if it is low, he will prefer cotton. In the table the ratio 100

denotes that an acre of cotton brings the same price as an acre of wheat ; 150 means that an acre of cotton fetches 1½ times the price of an acre of wheat, and so on.

The first five years dealt with in this table cover the " boom " and the " slump " connected with the Civil War in the United States. It will be observed that the area did not respond at once to the famine prices of 1863, but that in 1864 an enormous area was sown. Some district officers at the time took credit for the increased area in their districts ; how far their action was really effective, is a matter that need not now be determined, but it is probable that most of the increase was due to the hope that the high prices had come to stay. This hope was disappointed, for that year's crop sold at prices which left no profit, and in 1865 the area fell by one-half.

It is difficult to speak with certainty about matters that occurred so long ago, but from conversations with men who remember the time, I have formed the idea that the effects of this " slump " on the imagination of the people was very great, and that the cotton crop became very unpopular for at least a decade. If we omit the year 1868, for which prices are not available, it will be seen that in the 24 years up to 1890 cotton was more valuable than wheat in 16 years, but that the area ruled low until 1876 : at that time the ratio had been above 100 in eight of the ten years that had elapsed since the slump and below it in two only ; in the eight years it had averaged 143 (or nearly three to two), and the average area sown in these years was 1,147,000 acres, while in the remaining two years the ratio averaged 89, and the area 9,63,000 acres. Thus, years of high ratio had higher areas than years of low ratio, in accordance with what might be expected, but the areas in high and low years alike, were less than the gradual development of the provinces gave reason to expect.

The year 1877 forms an abrupt break in the statistics ; in some parts of the cotton tracts there were literally no rains at all, and no conclusion can be drawn from the area figures. After this year it appears that the unpopularity of the crop was giving way before the series of high ratios that had followed the slump, and in the decade from 1881 to 1890 the standard was about 1½ million acres. In the thirteen years from 1878 to 1890, the ratio was above parity in seven ; in these it averaged 122 and the area averaged 1,543,000 acres : while in six years the ratio averaged 90, and the area 1,468,000 acres. Here again the years of low ratio are years of comparatively low area, but the fact that the area in them was not still lower must be attributed to the renewed popularity of the crop. Over the whole thirteen years the average ratio was only just above parity, but the steady high prices of the previous decade had established the custom or fashion of sowing cotton.

At last, however, this popularity began to wane ; from 1887 to 1890 prices were unsatisfactory, and after the latter year, a marked drop in the area is apparent ; it was undoubtedly aided by unfavourable sowing seasons, as the rains were very late both in 1891 and 1892, but in 1893 with a favourable season the area was much lower than the experience of the eighties would have suggested. The years from 1891 to 1904 are, on the whole, a period of low ratios : the ratio was above 100 in only four, when it averaged 121, and the area averaged 1,343,000 acres : while it was 100 or less in ten, averaging 82, with an area averaging 1,196,000 acres.

Comparing the areas in the two sets of years of high ratios, it is seen that in the first a ratio of 122 brought out an annual area of over $1\frac{1}{2}$ million acres, while in the second a practically equal ratio (121) brought out 200,000 acres less : this difference is the measure of the cumulative effect of a series of years, of success in the first case and of failure in the second. The disparity between the two sets of years of low ratios is even more pronounced, but part of it is attributable to bad sowing seasons, as the rains have been late in the later period much more frequently than past experience would have suggested.

The table then seems to show that the area tends to fluctuate from year to year in accordance with the ratios of prices, but that the cumulative effect of a series of years of high or low ratios, is a most important factor in determining the absolute area, as distinct from the fluctuations. It is here that the motives which I have described as fashion and prejudice come into play.

It will be seen then that at the present time cotton has a good deal of prejudice to live down ; for nearly a decade the ratio has stayed below parity, and in 1904 when it rose to a point higher than for 19 years past, the area was roughly $\frac{1}{4}$ million acres below what the experience of the later eighties would have suggested. Whether the prejudice will last for a decade on this occasion remains to be seen ; there are grounds for hoping that the reduction of water-rates and the extension of the canal systems, will counteract the effects of the past range of low prices, and possibly the effects of custom may not last so long. But the fact remains that the experience of the last decade must act as a drag on expansion for many years to come.