

A NOTE ON THE ORANGE RUST OF WHEAT.

By T. S. RAMAKRISHNAN, M. A.

The world over wherever wheat is grown it is known to be infected by 'rusts' which occasion considerable losses. Three kinds of rusts have been observed on this useful cereal:—yellow rust caused by *Puccinia glumarum*, black rust brought on by *Puccinia graminis* and orange rust due to *Puccinia triticina*. The two latter are world wide in their distribution while the former has not been recorded from South Africa or Australia. All the three however have been observed in India. In this paper are recorded some of the observations made during 1926–27 on the Central Farm, Coimbatore on a wheat crop which was badly affected by orange rust.

Research elsewhere has shown that nutrition exerts a great deal of influence on the susceptibility of plants to diseases. Excess of nitrogenous food predisposes plants to certain diseases. Phosphates have the reputation for increasing the resistance of plants to diseases, and potash is found essential for the maintenance of their natural resistance. At Woburn in England, the nitrogen plots in the manurial series were found worse affected by rusts than other plots, and at Rothamsted wheat rust was severe in potash starved plots.

In order to find out the relative influence of different manures on the intensity of orange rust a close examination was made of the crop in the new series of Permanent Manurials (F. No. 45). In this field there were two sets of ten plots, one being a duplicate of the other. The different manures were N, N+K, N+P, N+K+P, K+P, K, P, cattle manure and cattle manure duplicate and there was in addition a no manure plot. These plots were laid out in the middle of the field and were surrounded by a wide belt of outskirts.

This field was sown with the local variety of wheat on November 15, 1926. Germination was good. The crop came up well and was free from disease till the third week of December. In the first week of January rust appeared and spread from the outskirts to the middle of the field where the manurial plots were located. In the course of a fortnight the disease had spread over all the plots and almost the whole field became infested with the

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rust. This period was characterised by heavy dews in the mornings. The daily humidity ranged from 61° to 89·5° in December and 70° to 85° in January. The daily maximum temperature varied from 80·5° to 87·6° in December and 89° to 83·7° in January and the daily minimum temperature oscillated between 58·7° to 68·1° in December and 57·5° to 72° in January.

Neither yellow rust nor black rust was observed on any plant. Orange rust alone was present. The leaves showed characteristic orangecolored *uredo* pustules in large numbers. *Teleuto* spores of this fungus which are reported as of rare occurrence elsewhere were observed in plenty on the undersurface of leaves. All plants bore the rust. There was no healthy plant in the whole series of plots. There was nothing to choose between any two plots in both the sets in regard to the intensity of rust-attack. If one season's results are any indication one may say that manuring has little effect on the incidence or intensity of infection of the orange rust.

The damage caused by orange rust was visible even to a casual observer. The leaves and stems turned yellow, the crop presented a poor and dried up appearance. The earheads were prematurely and rapidly ripening. The grains were small and shrunken. In extreme cases there was no grain formation. In a portion of the outskirts small groups of plants were noticed which continued free from rust throughout. In order to study the effect of the disease on the yield of the crop four plots were marked out—two in a diseased portion of the outskirts and the other two in an area which was free. These plots were harvested separately and the weights of straw and of spikelets were noted.

Plot.	Gross weight of crop.	Weight of straw.	Weight of spikelets.
Diseased original ...	8·4	3·9	2·2
Do. duplicate ...	6·5	2·8	1·8
Healthy original ...	15	5	2·6
Do. duplicate ...	13	4·4	2·4

N. B.—Area of plot 13' × 5'. Figures in pounds. Percentage of loss 20.

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in pounds. Percentage

Australian experience is that black rust inflicts more damage than orange rust while in India the results of experiments carried out several years ago have shown that black rust is not so harmful as the other two. Butler mentions in his "Fungi and Diseases in Plants" that owing to different kinds occurring so frequently together in bad years it is difficult to find out which does more damage. As at present orange rust alone appeared in the field under observation, no comparative estimate of the losses caused by the different rusts could be made. It was however possible to arrive at an idea of the loss sustained from orange rust because of the presence of some healthy plants in the same field growing under the same conditions.

Besides estimating the yields from different plots four groups of plants each in various stages of infection were selected in the outskirts area and the effects of the disease on the plants compared. The groups represented plants which were (1) badly diseased and prematurely dried up, (2) badly diseased but remaining green for a longer period than No. 1 and (3) plants the lower leaves of which were free from rust and (4) plants which were free from rust. These plots were individually harvested, threshed and weights of straw and spikelets recorded. The results are below:—

Group No.	Condition of plants.	No. of plants.	Total number of tillers.	Weight of straw in grams.	Weight of spikelets in grams.
1.	Severely infected and pre- maturely dried up ...	10	166	232	126
2.	Severely infected but re- maining green for a longer time than 1 ...	10	230	358	174
3.	Lower leaves alone infec- ed ...	10	179	310	194
4.	Free from rust ...	10	273	414	317

From the above, the adverse effect of the disease on the plants can be easily judged. The loss is severest when the plants are infected earliest, but if the infection occurs towards the later stages of the crop the damage is less.

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To arrive at a clearer estimation of the injury caused 400 spikelets collected at random in lots of 100 from each of the four groups mentioned were weighed separately and compared. The weights were:—

WEIGHT IN GRAMS OF SPIKELETS.

Lot.†	Group I.	Group II.	Group III.	Group IV.	
1	4	4	7	7	
2	4	6	7	8	† Each lot of 100
3	5	6	7	8	spikelets
4	6	6	7	7	
Total	19	22	28	30	

The spikelets from plants which are diseased weigh much less than those from healthy plants. Lighter spikelets contain lighter grains.

A similar estimation of the weights of grains from the 4 different groups was made with the results noted below:—

WEIGHT IN GRAMS OF GRAINS.

Lot.†	Group I.	Group II.	Group III.	Group IV.	
1	1.4	2.2	3.5	3.8	
2	1.75	2.1	2.9	3.2	† Each lot
3	2.25	2.8	3.0	3.4	100 grains.
4	1.8	2.4	3.6	3.7	
Total.	7.20	9.5	13.0	14.1	

The grains from badly diseased plants are very small and shrunken. They weigh only about half as those from healthy plants, and fetch a low price in the market. The degree of loss is however dependent on the stage of infection, those that are affected very early being the most heavily damaged. The degree of damage is also dependent on other factors viz. conditions of the weather and the morphological characters of the variety infected. It should however be added that observations recorded here are confined to one season alone and further trials may be necessary before arriving at any definite conclusions.

I am grateful to the Government Mycologist for affording facilities to record the observations noted above.

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