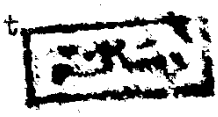
STUDIES ON DOWNY MILDEW DISEASE OF ONION IN U.A.R.

By

Ibrahim Sadek Ahmed Elewa

Thesis Submitted in Partial Fulfilment
of the Requirements for
The Ph.D. Degree
in
Plant Pathology



Ain Shams University
Faculty of Agriculture
Plant Pathology Dept.

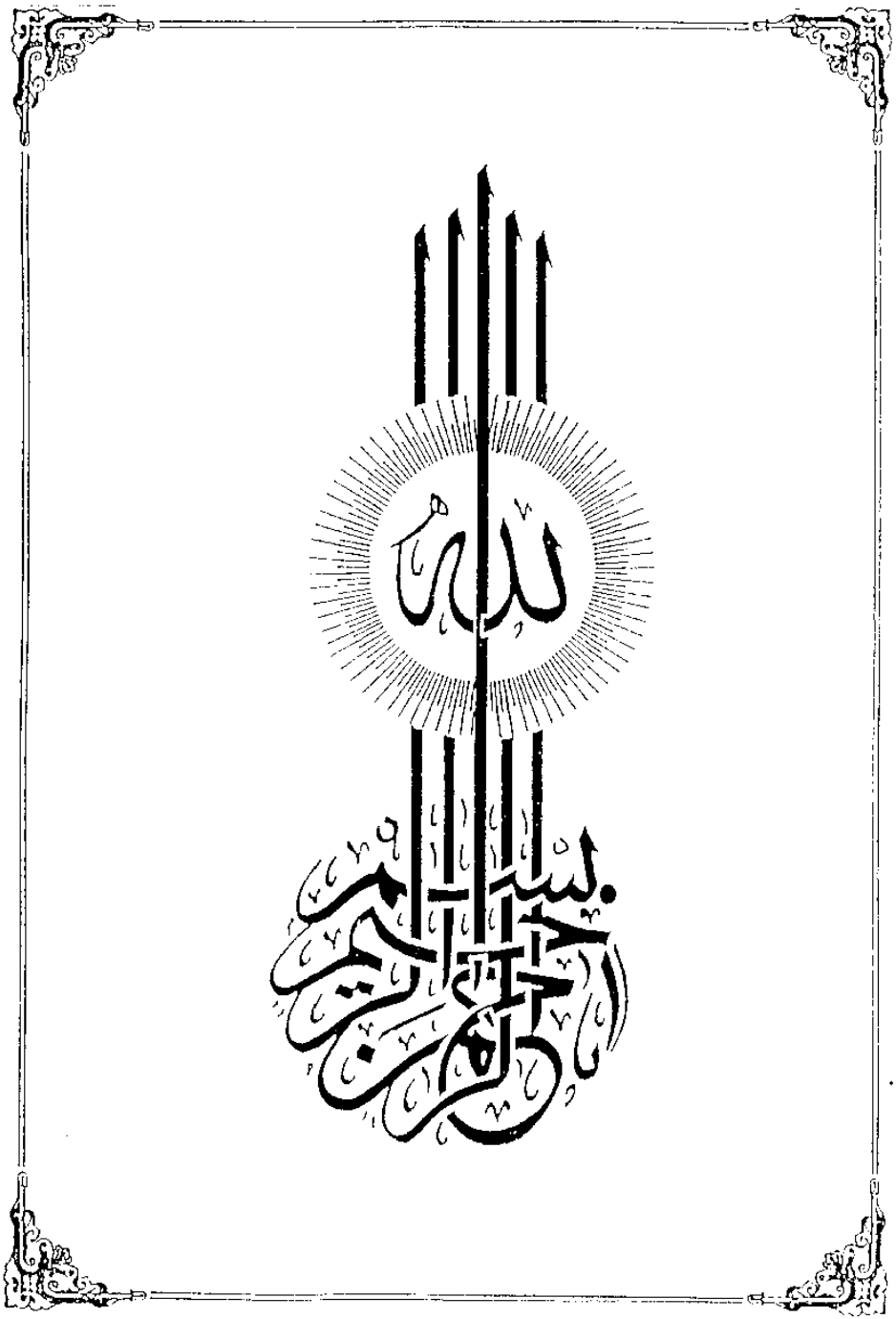
1970

APPROVAL SHEET

This Thesis for the Ph.D. Degree has been Approved by :

Date : ____ / ____ / 1970

...ooOoo...



A C K N O W L E D G M E N T

This work was carried out in the Plant Pathology Dept., Faculty of Agric., Ain Shams University, under the supervision and direction of Prof. Dr. W.A. Ashour, Professor of Plant Pathology; Prof. Dr. A.R. Sirry, Professor of Plant Pathology and Dr. A. Raafat, Associate Professor of Plant Physiology, in the same department.

The writer wishes to express his deepest gratitude to them for suggesting the problem, supervision, keeping interest, progressive criticism and encouragement throughout the whole work.

...ooOoo...

C O N T E N T S

...ccOoo...

I N T R O D U C T I O N

Onion represents one of major crops in U.A.R. It ranks nearly the first among other vegetable crops as far as exportation is concerned.

The downy mildew disease of onion caused by *Peronospora destructor* Berk. is one of the most deleterious diseases. It affects the yield and the quality of seeds and bulbs. Severe attack by the disease usually occurs in humid conditions. Thus, it is supposed to cause great losses in the Delta. Moreoevr, this disease was also obscrved by the writer in Upper Egypt. Infection usually results in the death of the diseased tissues. If the relative humidity is high in the field, the disease spreads quickly in the whole field and causes great loss in bulb yield. Serious losses always occur when the attacked crop is used for seed production. In U.A.R. the pathogen undergoes an over-summering period in the bulbs in the form of resting mycelium or as cospores in plant residues. The present investigation was planned to study the effect of NPK fertilizers either single or in combination at different levels on the disease severity, growth and yield was studied.

This study was carried out in two seasons, namely 1967 and 1969, in the case of bulb and seed production. The effect of the disease on the plant growth under all fertilizers treatments was also investigated on different plant parts. Moreover, a comparative study was made between diseased and healthy foliage with respect to chemical composition under all fertilizer treatments.

The effect of spraying with some carbamate fungicides which were recommended to prevent the disease was investigated under field conditions. The effect of these fungicides on disease severity, yield and chemical composition of both the healthy and the diseased parts of the plant was also studied. Moreoevr, an experiment was conducted to study the effect of one of these fungicides (Dithane Z-78) on the rate of respiration of the healthy and diseased parts of the plant.

REVIEW OF LITERATURE

Peronospora destructor Berk., the causal organism.

Berkeley (1841); Trelease (1884); Cook (1932); Heald (1943); Lavallée , Simmonds and Tims (1947); Moore (1949); Anon (1950b); Bazán de Segura and Nelson (1951); Agati et al.(1954); Doepel, Hardie (1955); Kefford, Jones (1956); Berry, Davis, Woolliams and Zanardi (1957); Wheeler (1959); Van Doorn (1960); Khristodorov (1962); Jovicevič and Kazakova (1964), stated that the fungus Peronospora destructor is the causal organism of downy mildew disease of onion. In the Governorates where onion is grown for seeds or bulbs, the disease is widespread and very destructive.

Effect of fertilizers on disease severity :

Tico (1952) stated that sources of plant nutrients for onions as $(NH_4)_2SO_4$, $NaNO_3$, superphosphate and K_2SO_4 produced bulbs of high keeping qualities, and protected the plant from fungal diseases.

Geard (1959) got promising control of downy mildew of onion by the avoidance of excessive nitrogen application.

Van Doorn (1960) found that restriction of nitrogenous fertilizers could be recommended as a control measure for the disease in Holland.

Sirry et al.(1969)found that application of fertilizers reduced white rot disease and increased the yield of onion. This beneficial effect was significant when the amount of fertilizers were increased up to 400 kg. N; 400 kg. P, and 100 kg. K per faddan.

Effect of fertilizers on the growth and yield of onion :

Davis et al. (1951) indicated that fertilizers for onions are best placed in a band 2 in. below seed level either 1 in. to the side or directly under the seed, provided that the rate of application does not exceed 1.000 lb. per acre.

Iwata and Taniuchi (1953) found that high nitrate gave excellent growth of onion plant (in sand culture treated with 7 nutrient solutions). On the other hand, high ammonium caused stunting. The latter gave higher total nitrogen and phosphorus in the leaf in other crops but not with onion.

Kaljtja (1954) reported that PK application before seedling and N when the first leaf appeared gave

the highest yield of onion.

Campbell (1955) showed that applications of K decreased the yield of onions, but increased K and decreased Na percentages in the plant.

Lorenz et al. (1955) studied the effect of liquid, dry and gaseous fertilizers on onions in sandy loam soil. In the nitrogen tests, best yields resulted from ammonium sulphate placed under the plant row, whereas that applied in the irrigation water gave much lower yields. Liquid phosphoric acid and treble superphosphate produced equal yields.

Cavazza (1956) found that increase in both yield and average weight of onion bulbs was obtained by applications of each ammonium nitrate, ammonium sulphate and ammonium chloride at the rates of 650 to 800 kg./hectare.

Das and Dhyani (1956) tested four levels of nitrogen as sulphate of ammonia and 4 spacings in a field trial with Panta Red onions. They obtained the results: 80 lb. N/acre with 9 to 12 in. spacing was optimum for fresh and dry weight of tops, height of plant and size of bulb; 60 lb. N was best for fresh and dry weight of bulb with 12 in. spacing; highest yield in weight was

obtained with 60 lb. N and 4 in. spacing.

Cornejo (1957) working on onion, in factorial N,P,K trials where amounts of fertilizers applied per hectare were 600 kg. of ammonium sulphate, 720 kg. of superphosphate and 260 kg. of potassium chloride. Results indicated that N + P gave the highest yield and K produced less than the unfertilized control. Keeping quality was highest in bulbs grown without fertilizer or with P only. Yields from N + P + K were not far below those from N+P.

Hori et al. (1958) reported that a basic application of 400 - 500 lb. of P per acre was required for adequate onion yields following a cabbage crop, and liming was also necessary in strongly acid soils.

Itagi et al. (1958) reported that growth and yield of onion bulbs were correlated with N applications. Phosphorus appeared to be more essential than N or K for good growth.

Downes (1959) found that nitrogen was a limiting factor in onion growth. Nitrogen application resulted in a significant increase in the growth of leaves and of bulbs. Phosphorus at a high level significantly increased bulb growth and accelerated maturity and also decreased leaf growth in comparison with low P levels. Application

of P resulted in an increase in bulb concentrations of P but did not affect the P content of the leaves. Potassium increased both leaf growth and bulb yields and tended to counteract the detrimental effect of excessively high N.

Balan (1960) found that the application of 180 kg. of ammonium nitrate, 330 kg. of superphosphate and 175 kg. of potash per hectare to onions, during the growing period, increased the sugar, ascorbic acid, and dry weight contents of the bulbs and produced higher yields.

Iwata et al. (1960) found that onion bulb yields were not reduced by omitting the nitrogen supply for one month. Nitrogen and dry matter content in the onion tops increased from March to May. In bulbs,N and dry matter contents increased rapidly from middle or late April until harvest.

Paterson et al. (1960) worked in 1957 and 1958 on 3 onion varieties. 3 x 3 x 3 N, P and S factorial experiments were carried out with N applied at 0, 50 and 100 lb./acre, P_2O_5 at 0, 50 and 100 lb. and S at 0, 25 and 50 lb. They found that S had no significant effect on yields. Phosphorus increased the yields of both marketable and cull onions in both years. Nitrogen increased the yield of marketable onions and decreased that of cull

onions in 1957 but evoked no clear-cut response in 1958 when growing conditions were relatively poor. In 1957, the application of N increased the N content of the bulbs and decreased their P content; P_2O_5 at 50 lb./acre produced a highly significant increase in the P content of the bulbs. The 100 lb. rates of both N and P_2O_5 significantly increased the K content of the bulbs.

Butt (1961) showed that the yield of Giza 6 variety significantly increased with increase in nitrogen and phosphorus supply to plants.

Kageyama et al. (1961) stated that absorption of N, P and K by onions was in the proportion of 3 : 1 : 4. Greatest increases in yield were obtained with early P applications at the time of rapid shoot growth. Later P applications promoted luxurious leaf growth.

Lingle and Wight (1961) found that rates of N fertilizer above 100 lb. per acre had an adverse effect on the growth of onions. The leaf contents of Mn. in these plants were much higher than in plants receiving less N. The effect of ammonium sulphate in this respect was greater than that of ammonium nitrate or calcium nitrate.

MacKay and Chipman (1961) applied N, P and K to

organic soil. They found that yield of onion responded strikingly to N up to at least 240 pounds N per acre. The effect of P was scarcely significant. That of K was not significant.

Ruf (1961) found that onion given as 50 lb. N/ acre at sowing in March and 100 lb. N/acre as a side - dressing in mid-June yielded 29.4 tons/acre. Yields were similar in plots where 100 lb. N was applied at sowing. Control plots produced 5.8 tons.

Abd El-Raheem (1963) stated that the yield of onion plant was not affected by variations in NPK fertilizer treatments.

Wayse (1968) studied the effect of NPK trials on Kharif and Rabi onion crops. He found that there was no response to P application and a significant response to K in the Kharif crop was shown to be uneconomic. Significant yield increases in both crops resulted from N applications; rates of 44 lb. N/acre for the Kharif crop and 55 lb./acre for the Rabi crop were estimated to be the optimum economic doses.

The growth of onion plant :

Taguchi (1948) following autumn planting of