

The effect of nitrogen application on the development of rusts on wheat varieties

HAGGAG M.E.A., EWEIDA M.H.T. AND, F.F. EL-SAYED

Faculty of Agriculture Al-Azhar University, Cairo, A. R. Egypt

Haggag M.E.A., Eweida M.H.T. and F.F. El-Sayed, *The effect of nitrogen application on the development of rusts on wheat varieties*. Acta Mycol. XII(2): 191-194, 1976 (1977).

The effect of four different levels of nitrogen fertilization on the severity of rusts on three local Egyptian wheat varieties have been investigated. Nitrogen fertilizer was at the rates 0, 40, 60, and 80 kg nitrogen per feddan. Data obtained indicated that resistance of the varieties did not change while percent severity of postules on susceptible, moderately susceptible and moderately resistant varieties was increased as the level of nitrogen fertilization increased. Heavy doses of nitrogen promoted the size and frequency of postules and hence the rust growth and predisposed the plants to higher infection with rusts.

INTRODUCTION

Wheat production in the Middle East Countries is seriously threatened by losses from rust diseases; stem rust (*Puccinia graminis* Pers. f. sp. *tritici* Erikss. et Henn.), leaf rust (*P. recondita* Roberge) ex Demazières and stripe rust (*P. striiformis* Westend.) (Abdel-Hak, Stewart, Kamel 1972).

Attempts have been made to increase productivity of wheat cultivars through the utilization on high levels of nitrogen fertilization. However, such practice may encourage other factors as rusts which reduce the end product yield. Hursh (1924) reported that nitrogen fertilization probably increased the area in which fungus can live, and thus heavy applications of nitrogen rendered the wheat plants more liable to damage from enlarged postules of rusts. Gassner and Hassebrauk (1931) indicated that heavy doses of nitrogen prolonged the sporing period of rusts and that nitrogen fertilization always promoted the rusts on wheat plants.

On the other hand, Stakman and Asmodt (1924) emphasized that the degree of physiological resistance or susceptibility of the wheat variety was not directly influenced by the fertilizers employed. They added that morphological resistance however, might be slightly modified as the fertilizers appear to have a direct influence on the growth of the plant.

The aim of this investigation was to study the effect of four levels of nitrogen fertilization on the development and severity of rusts on three Egyptian wheat varieties (*Triticum aestivum*).

MATERIALS AND METHODS

The wheat varieties tested were the local cultivars Tosson, Giza 144 and Giza 155. The first one is susceptible to stem and leaf rusts but moderately susceptible to stripe rust. Giza 144 is resistant to stem rust, moderately resistant to leaf rust and susceptible to stripe rust. The last variety is resistant to stem rust, susceptible to leaf rust and moderately resistant to stripe rust.

The rates of nitrogen fertilization applied were 0, 40, 60 and 80 kg. nitrogen per feddan (feddan = 1.05 acre) in the form of ammonium nitrate (31% N). Calcium superphosphate (15% P_2O_5) were applied before sowing at the rate of 100 kg. per feddan. Each of the nitrogen doses was divided into two portions; 2/3 applied immediately before the first irrigation and the other portion was supplied before the second irrigation.

The study was carried out over the two successive growing seasons of 1971 and 1972. The experiment was laid out in a strip-plot design with six replications in each season. Plot size was 3×3.5 m. and rows were 30 cm. apart.

Leaf and stripe rusts were recorded when plants were at the 2nd or 3rd leaf stage while reaction to stem rust was observed as plants reached the flag stage. Reactions of plants to stem and leaf rusts were recorded according to the system described by Peterson, Campbell and Hanna (1948) based on percentage of total leaf area covered by lesions and considering postule size, shape and frequency. Readings of stripe rust were recorded according to the International Scale for assessment of yellow rust on wheat and barley as indicated by Zandoks (1963).

RESULTS AND DISCUSSION

Average reactions of the wheat varieties tested to stem, leaf and stripe rusts as affected by the four nitrogen fertilization levels over the two seasons of experimentation are presented in Table 1.

Susceptibility of the variety Tosson to stem rust increased with the application of nitrogen fertilizer. However, the two stem rust resistant

Table 1
Average reactions of the wheat varieties to rusts at the four levels
of nitrogen application

Varieties Nitrogen rate (kg./feddan)	Rust reactions					
	1971			1972		
	stem	leaf	stripe	stem	leaf	stripe
Tosson						
0	40 S	30 S	25 MS	30 S	25 S	20 MS
40	60 S	60 S	30 MS	50 S	50 S	30 MS
60	75 S	70 S	45 MS	70 S	65 S	40 MS
80	85 S	85 S	60 MS	85 S	80 S	60 MS
Mean	65 S	61 S	40 MS	59 S	55 S	38 MS
Giza 144						
0	R	25 MR	40 S	R	20 MR	35 S
40	R	50 MR	60 S	R	45 MR	50 S
60	R	60 MR	75 S	R	60 MR	70 S
80	R	70 MR	90 S	R	75 MR	85 S
Mean	R	51 MR	66 S	R	50 MR	60 S
Giza 155						
0	R	20 S	10 MR	R	10 S	5 MR
40	R	40 S	20 MR	R	35 S	15 MR
60	R	50 S	30 MR	R	50 S	20 MR
80	R	60 S	40 MR	R	65 S	40 MR
Mean	R	42 S	25 MR	R	40 S	20 MR

S: Susceptible.

R: Resistant (100%).

MS: Moderately susceptible.

MR: Moderately resistant.

varieties Giza 144 and Giza 155 did not show any change in their resistance when different nitrogen levels were supplied.

The rust readings concerning leaf rust indicated that severity of rust on Tosson and Giza 155 was enhanced as the level of nitrogen application was increased. In addition, recorded reaction of the moderately resistant variety Giza 144 to leaf rust showed an increase in severity of infection of postules as the nitrogen level was raised.

As far as stripe rust was concerned, raising the amount of nitrogen fertilization increased the severity of rust on plants regardless of the level of resistance or susceptibility possessed by the wheat variety.

In general, the results obtained are in agreement with previously reported findings of Hursh (1924) and Gassner and Hassebrauk (1931). Regarding the rust fungi, it is indicated that nitrogen

application increased the size and frequency of postules on leaves and stems of the wheat plants and probably increased the period of sporulation of the fungi concerned as reported by Gassner and Hassebrauk (1931).

It is also clear that application of nitrogen promoted vigorous growth, delayed maturity and tended to cause thin cell walls. Therefore, fungi may have penetrated the thin walls more easily and increased the severity of rusts on plants. This conclusion adds more support to the findings of McNew (1933). However, since the resistance of the variety Giza 155 is due to specific genes for resistance (El-Fiki 1970) and not due to morphological or mechanical factors, it did not lose its resistance and the stem rust fungus was not able to live on this variety.

On the base of evidence of the present study, ultimate productivity could be achieved with the use of high levels of nitrogen fertilizers on wheat varieties resistant to the prevailing rust races in the area of production in order to avoid the increases in size frequency and severity of rust postules. Stakman and Aamodt (1924) reported that no fundamental changes had occurred in the degree of physiological resistance to stem rust when plants were supplied with nitrogen fertilization. But since resistant varieties succumb to new races or to changes in rust populations within few years of their release (1973), it is of great importance to carry on soil fertility studies along side with testing for resistance of the wheat varieties to rusts.

LITERATURE

- Abdel-Hak T., Stewart D. M. and Kamel A. H., 1972, Paper presented at Regional wheat workshop, Beirut, Lebanon, 14-17.
- El-Fiki F. A., 1970, M. Sc. Thesis, faculty of Agriculture Al-Azhar University, Egypt.
- Gassner G. and Hassebrauk K., 1931, *Phytopathology Z.* 3: 535-617.
- Haggag M. E. A. and Dyck P. L., 1973, *Can. J. Genet. Cytol.* 15: 127-134.
- Hursh C. R., 1924, *J. Agric. Res.* 27: 381-411.
- McNew G. L., 1953, *The Yearbook of Agriculture*, pp. 100-114 (U.S. Dep. Agric. Washington D.C., pp. 940).
- Peterson R. F., Campbell A. B. and Hanna A. E., 1948, *Can. J. Res. (c)*, 26: 496-500.
- Stakman E. C. and Aamodt O. S., 1924, *J. Agric. Res.* 27: 341-379.
- Zadoks J. C., 1963, *Barley Genet. Symp.*, 1st Wageningen, 242-249.

Wpływ nawożenia azotem na rozwój rdzy na odmianach pszenicy

Streszczenie

Badano wpływ czterech różnych dawek nawozu azotowego na patogeniczność rdzy z trzech egipskich odmian pszenicy. Stwierdzono, że odporność odmian nie zmieniła się, natomiast wzrastał stopień porażenia odmian podatnych, średnio odpornych, wraz ze wzrostem dawki nawozu. Duże dawki azotu zwiększały wielkość i częstość występowania skupień zarodników a więc i wzrost rdzy, i czyniły rośliny podatniejsze na ciężką infekcję.