



The incidence of Early blight diseases in Tomato plants at different varieties to determine resistance varieties

White Nile State Season (2018-2019)

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Abstract

Likewise, six varieties of tomato were screened for their resistance to early blight disease under natural infection conditions namely, Castle Rock, Strain B, B286, Hiraihry, Goal, Domestic (Local one)). The results of the screening of tomato varieties for resistance to early blight disease under natural infection attest the high level of resistance of the domestic variety to the disease (33.3%) followed by strain B (55.6%) and B286 (77.8%) compared to other varieties where the percent of disease incidence range from 88.9 to 100% infection. Nevertheless, this comparatively low level of disease incidence in these two varieties was coupled with high productivity in comparison to other varieties. Results Mean percent incidence of early blight disease on some tomato varieties screened for their resistance to the disease under natural infection. The results of the interaction of tested tomato varieties with early blight disease under natural infection were presented in table 8. All tomato varieties screened for evaluation of their resistance to the disease were infected but at variable level. Nevertheless, the domestic variety (Allah Kareem) showed low percent of disease incidence with 33.3% followed by the hybrid Strain B compared to other tested varieties. The other varieties exhibited high level of disease incidence ranging from 77.8 % with B2-86, 88.9 with varieties Castle rock and Hiraihry and 100 % with Goal.

Keywords: The incidence, Early Blight Diseases, Tomato plants, different varieties, determine resistance varieties.

Introduction

Tomato Production in Sudan: Winters are the major seasons for production where both productivity and quality are at their best. Summer production is faced with harsh hot-dry conditions especially in Central Sudan. The main production areas of Tomato in Sudan are Gezira and Managel Scheme, Khartoum, Blue Nile, White Nile, Kassala States and Western State.

The crop is also produced in Jabel Marra and some parts of the main rain fed areas around villages in central clay plains and utilized as sun dried slices (FAO, 1999), summer production of tomato is produced in limited areas in Blue and White Nile and Khartoum state, Northern State. It ensures high profitability because of the scarcity of the crop at that time.

It is recently produced under controlled greenhouses during summer season and this practice is extending rapidly every year, one of the major constraints facing the production of tomato is the losses caused by fungal diseases, insects, nematodes and parasitic weeds. Among these early blight of tomato caused by *Alternaria alternata* is considered as the most important fungal disease of tomato plants (Agrios 2005). The disease becomes wide spread and serious in Sudan, causing large economic loss to the growers in all tomato growing areas.

The epidemic disease occurs annually across all seasons wherever tomatoes are grown. In spite of its name, the disease may occur any time during the growing season; the disease is particularly destructive during summer production. The fungus attacks leaves, stems and fruits and is known to attack on potato, pepper and eggplant and *Datura sp.*

Furthermore, the nature of damage and survival ability of the fungus which can survive in soil and plant debris in the absence of susceptible host (Delahat and Sterenson, 2004, 2014) render the

management of Early Blight of tomato more difficult. In fact, the problem of the disease control was even more complicated by controversy around the geographical distribution and seasonal occurrence of the two species of the genus *Alternaria* (*Alternaria alternata*, *A. solani* and *A. tenuis*) causing early blight in tomato (Giha, 1973; Pandey et al., 2003 and Reni and Roeland 2006).

However, the disease has been managed primarily by the use of resistant varieties (Jalali and Chand, 1992) but breakdown in resistance of these varieties due to evolution of virulent races of the pathogen have undermined their importance in recent years (Haware and Nene, 1982). In most cases chemical control methods are in practice. However, although the use of chemicals has helped increasing yields obtained (Ali, 1996), but the worldwide trend to world environmentally-safe methods of plant diseases control have initiated the exploration of safe alternate products.

Apparently, insecticides were considered indispensable for sustainable agriculture production but, their increasing and irrational use has become a source of great concern because of their possible effect on human health and non-target components of the environment. This concern is heightened by the non-specificity and high toxicity of some pesticides and development of resistant strains of microorganisms against other ones.

Objectives Main objective: The main objective of this study is to improve tomato productivity by developing a package of integrated control measures that offer several options for farmers to manage early blight disease of tomato in White Nile State production areas.

Specific objectives are to:

Conduct a field survey to determine relative occurrence of *Alternaria alternata* and quantify the damage and level of disease incidence caused by early blight'

Isolate and identify the genus *Alternaria*.

Explore the antifungal potentials of different formulations of some higher plants and fungicide against infection of tomato plant under field conditions.

Screen and evaluate some tomato varieties and hybrids for resistance to early blight disease.

Identify reliable sources of resistance to early blight disease.

Literature review

Geographical Distribution: Many *Alternaria spp.* are recorded mostly in all countries around the world, whereas the presence of others is restricted to specific areas. *Alternaria spp.* on potato and tomato exemplifies the worldwide distribution of species, which spread from Iceland to Equatorial areas in South America and Africa and further south to cool parts of Chile and Argentina. Other pathogens of worldwide distribution include *Alternaria brassicaceae* (Anon., 1983) and *Alternaria brassicicola* (Millar and Pollard, 1976).

Symptoms

Stems, leaves and fruit of tomato are all are subject to infection by *Alternaria*. It may girdle seedling and causing damping off in the seedbed. On the leaves, brown circular spots are often surrounded by yellow area (Dillard, 1995). Leaf spots have characteristic dark concentric rings. Leaf spots usually appear on the oldest leaves first and progress to the upper parts of the plant (Castano Zacata, 1994).

The first symptoms usually appear on older leaves start with small irregular dark brown to black spot. As the spot enlarge, concentric rings may form as a result of irregular growth patterns of the

pathogen. This gives the lesion a characteristic shape such as “Target spots” or “Bull’s eye” appearance. There is often a narrow yellow halo around each spot (Pscheit, 1985).

Leaf symptoms are circular to oval spots appearing first on lower leaves. They may cause a collar rot of young tomato seedling, sunken spots or cankers on older stems, leads to blossom drop of young fruit (Westcott, 1971). Walker (1952) reported that in plant grown from infected seed, stem lesions are frequently occur and are elongated, sunken dark and donated up to 2cm in length.

Tomato plants were found susceptible to *Alternaria spp.* during all growth stages (Vloutoglou and Calogerakis, 2000). If infected seeds are used to start tomato, transplanted seedling might damp-off soon after emergence. Large lesions also develop at the ground level on stem of transplant or seedling. The plant may become girdled, a condition known as “Color rot”.

Such plants may die when set in the field or the stems are weakened and may break early in the season. On older fruits early blight also causes dark leathery, sunken spots usually at the point of stem attachment. These spots may enlarge to cover the whole fruit, often showing concentric marking like those on leaves. Fruits can also be infected while they are green or during ripening stage through growth cracks and other wounds, often drop before reaching maturity (Dillard, 1995).

Materials and Methods

Screening of tomato varieties for resistance to *Alternaria* spp Six commercial varieties of tomato, namely Castle Rock, Strain B, B2 (86), Hiraihy (Local variety), Goal and Domestic one (local name, Allah Kareem, as resistant check) were used in this experiment. The land preparation and cultural practices were done as described before. Thirty plants of each variety were assigned to each plot of 3m x 2.5m size. Plots were arranged in a randomized complete block design (RCBD) with three replications under field conditions for natural infection where natural inoculums pressure was high.

Collection of data

A total of 9 tomato plants were randomly selected from the centre of the three plots, three from each replication and visited each count to assess the disease incidence till 100% infection was reached by any one of the test varieties. The assessment started with appearance of first symptom of early blight disease (Agrios, 1997). At the end of five count visit the number of plants showed early blight symptoms among the nine plants were calculated and expressed as a percentage of the regularly inspected ten plants. Similar counts for percentage disease incidence on fruits were done. At harvesttime, the mean total yield was calculated for each variety, based on mean of four harvests of the crop during the season.

Data analysis

The obtained data were subject to analysis of variance for the randomized complete block design, using MStatC computer program. Means were separated by Duncan's multiple range test at $P = 0.05$.

Results

Mean percent incidence of early blight disease on some tomato varieties screened for their resistance to the disease under natural infection. The results of the interaction of tested tomato varieties with early blight disease under natural infection were presented in table 8. All tomato varieties screened for evaluation of their resistance to the disease were infected but at variable level. Nevertheless, the domestic variety (Allah Kareem) showed low percent of disease incidence with 33.3% followed by the hybrid Strain B compared to other tested varieties. The other varieties exhibited high level of disease incidence ranging from 77.8 % with B2-86, 88.9 with varieties Castle rock and Hiraihry and 100 % with Goal.

The effect of early blight disease on yield of different tomato varieties tested under natural infection

Table, 9 presents the results of the effect of early blight disease on total yield of four harvests of different tomato varieties under natural infection. Generally, the tested varieties which exposed to natural infection were given variable yield performance. Once again, the domestic variety and Strain B ranked the top in yield compared to other ones. The total yield obtained was significantly excelled that of other at $P= 0.05$. They yielded a total of 20.8 Kg and 20.4 Kg for variety Domestic and Strain B respectively after four harvests followed by 17.2, 14.1, 11.9 and 7.5 Kg for Castle rock, B2-86, Hiraihry and Goal respectively. It is worth mentioning that the Goal variety which scored the lowest yield total (7.5 Kg) gave the highest percent disease incidence under natural infection (100%).

Table 1: Mean percent incidence of early blight disease on some tomato varieties screened for resistance to early blight disease under natural infection

Varieties	Number of plants of positive infection among nine ones									Total Plants infected	Percentage Incidence
	1	2	3	4	5	6	7	8	9		
Castle rock	+	+	+	+	+	+	+	0	+	8.0	88.9%
Strain B	0	+	+	+	0	0	0	+	+	5.0	55.60%
B2-86	+	+	+	0	0	+	+	+	+	7.0	77.8%
Hiraihry	+	+	+	+	0	+	+	+	+	8.0	88.9%
Goal	+	+	+	+	+	+	+	+	+	9.0	100%
Domestic (control)	0	+	0	0	0	0	+	+	0	3.0	33.3%

Table 2: The effect of early blight disease on yield of different tomato varieties tested under natural infection.

Varieties	Weight(kg)				Total	Mean
	Harves t 1	Harvest 2	Harves t 3	Harves t 4		
Castle rock	3.1	6.4	5.0	2.7	17.2	4.3
Strain B	4.6	7.1	5.3	3.4	20.4	5.1
B2 -86	2.1	4.9	5.4	1.7	14.1	3.5
Hiraihry	2.0	4.3	4.6	1.0	11.9	3.0
Goal	1.0	2.6	3.0	0.9	7.50	1.9
Domestic	4.8	6.7	6.1	3.2	20.8	5.2

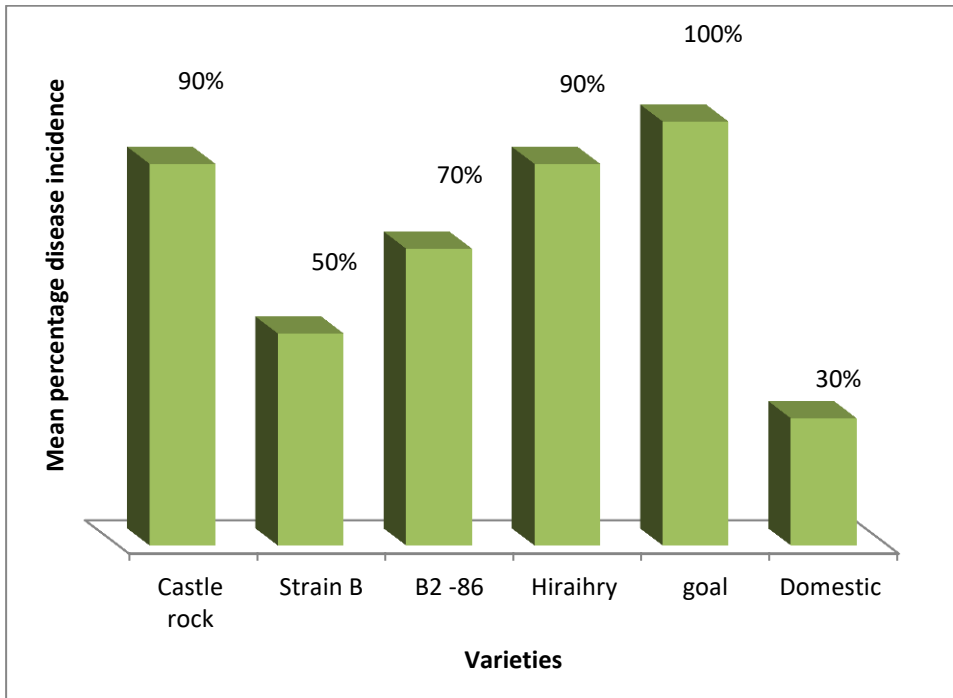


Fig.1: Mean percent incidence of early blight disease on some tomato varieties tested under natural infection.

Table 3: The effect of early blight disease on yield of different tomato varieties tested under natural infection.

Varieties	Weight(kg)
Castle rock	4.3 ^A
Strain B	5.1 ^A
B2 -86	3.5 ^{AB}
Hiraihry	3.0 ^{AB}
Goal	1.9 ^B
Domestic	5.2 ^A
LSD_{0.05}	2.39
SE±	1.14
CV%	4.12

No significant differences between means with the same letter(s) within column at P= 0.05

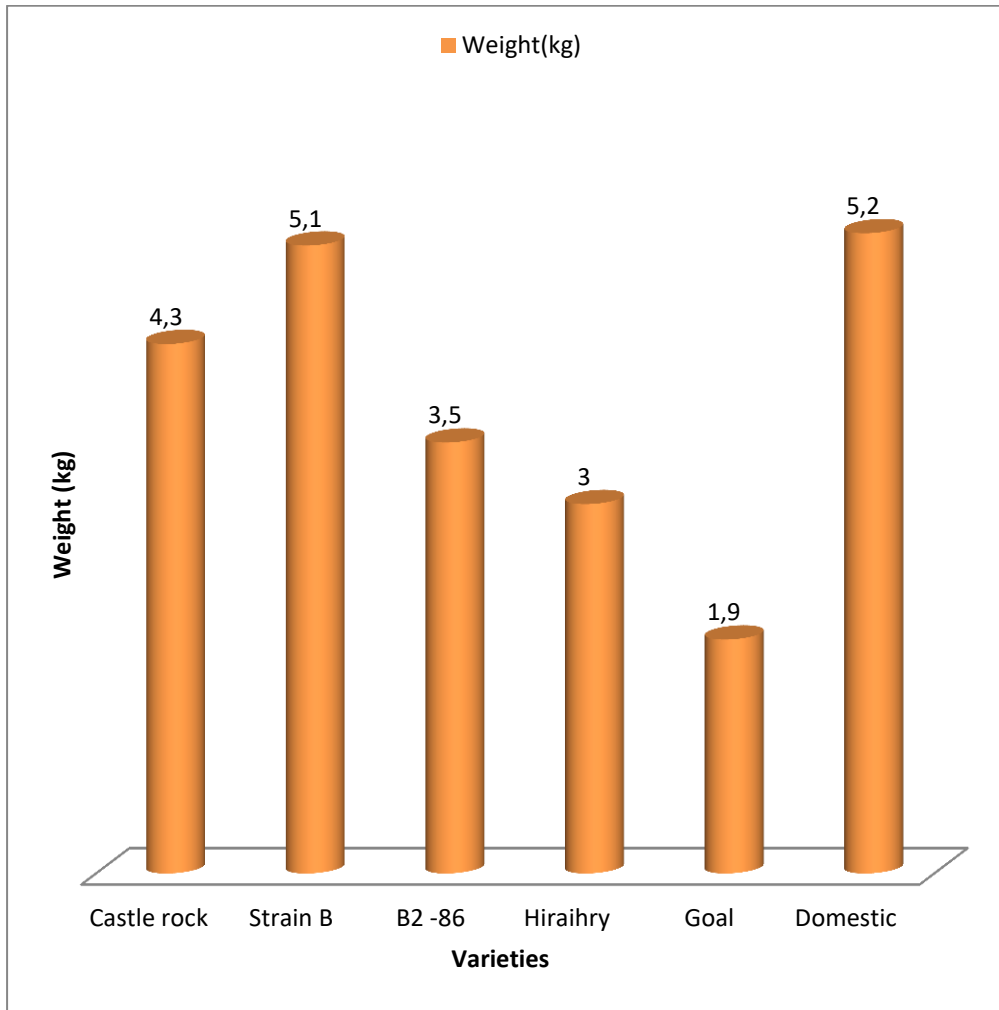


Fig.2: The effect of early blight disease on yield of different tomato varieties tested under natural infection.

Discussion

In fact, the disease has been managed primarily by the use of resistant varieties (Jalali and Chand, 1992) but breakdown in resistance of these varieties due to evolution of virulent races of the pathogen have undermined their importance in recent years (Haware and Nene, 1982).

Conclusion

The study also demonstrated clearly the variation of resistance to early blight disease among the different tomato varieties tested. Obviously, the domestic variety and strain B ones, showed highly significant resistance to the disease compared to the others where the disease incidence was relatively high. These results draw the attention towards the involvement of varietal resistance within the different management components in order to develop an integrated disease control strategy. This approach was also supported by Meitei, *et al.*, (2012.).

The results highlighted the importance of the varietal resistance as part of an integrated management approach to control early blight disease in tomato.

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