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A COMPARISON OF SORGHUM DISEASES IN TEMPERATE AND TROPICAL ENVIRONMENTS

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Sorghum is the principal source of energy and protein for over 300 million persons in Asia and Africa. Generally sorghum is grown in these tropical areas of the world on fields that are less suited for the other major cereals. In North America (Mexico and the United States), with approximately 45% of the world's production of grain sorghum, nearly all is used as a feed grain for livestock and poultry. As in the tropics, most of the grain sorghum is grown on the hot semi-arid plains within environments less suited for the other cereals.

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World production of grain sorghum is summarized as follows:

Region	Area (1000 hectares)	Production (1000 metric tons)	Production trends in the last 15 years
Europe	126	388	increasing
North America	5565	17706	increasing
Latin America	3438	6951	increasing slowly
Near East	1684	2307	no change
Far East	19417	10415	slight increase
Africa	7148	5805	no change
Oceania	397	572	increasing
World Total	44,196,000	(FAO yearbook of production 1970)	

Production increases for grain sorghum are probable. For example in North America nearly 19 million metric tons of grain are produced on 5.6 million ha whereas in the Far East 10 million metric tons are produced from 19 million ha. If the Far Eastern production per ha equalled that of North America, the area devoted to sorghum in the Far East would produce about 150 per cent more grain than is produced in the world today. The potential for grain sorghum in South America, particularly in Brazil, could increase the grain sorghum production by tens of millions of metric tons.

A direct comparison of sorghum diseases between the temperate zone and the tropics is difficult. The cultural practices are different. In East and West Africa and parts of Asia farmers keep different varieties for their personal use, many keeping their own seed stocks for generations as compared with the commercially processed high yielding hybrid seed developed for growers farms in North America.

In the temperate zones a determinant early maturing sorghum is preferred, while nearly all types of sorghum are found in Africa.

In Africa and India, sorghums are grown as dual or multi-purpose crops whereas in the U. S. sorghums are generally developed for a specific purpose i.e. grain, forage, fodder, sugar, broom making, etc. The pathogens and diseases of sorghum are summarized by latitude elevation and cropping season in Table 1. Because of these differences we have prepared statements on sorghum disease situations by major cultivation areas of the world before making further comparisons.

Sorghum Diseases in Africa

An insight into sorghum production, utilization, and marketing in Africa is useful in gaining an understanding of the disease situation. Practically all sorghum produced in Africa, aside from South Africa and parts of the Sudan, is grown by subsistence farmers for human food. Extremely little modern technology is used in production and utilization. Fertilizers, improved varieties, high plant populations, chemical control of weeds, insects, and diseases, and mechanization beyond the hoe, cutlass, and a stick or mortar and pestle for threshing, are practically unknown. Markets for grain are often limited to the immediate area of production. Sorghum is often grown as a mixed crop with other crops such as pearl millet, peanuts, or grain legumes. Several types of sorghum are often interplanted within the same field. Varieties used are generally tall, usually photoperiod sensitive, and relatively low yielding. They have undergone several centuries of natural selection and selection by farmers.

To date sorghum has received relatively little attention in Africa. However, this is likely to change fairly rapidly. Because of the present status of sorghum production, utilization, and marketing in Africa,

it is difficult to obtain accurate figures on yield, let alone estimate losses due to specific diseases or even disease as a whole. Diseases now cause in the neighborhood of 20% reductions in yield. As sorghum culture becomes more intensive in the future, opportunity for disease buildup will likely increase. Hopefully, this will be offset by simultaneous development of more disease control measures.

1. Foliar diseases

Practically all the pathogens listed (Table 1), with possibly the exception of Helminthosporium rostratum, H. sorghicola, Xanthomonas holicola and Pseudomonas syringae can be commonly found in most sorghum fields throughout Africa. Severe attacks by one or more leaf disease pathogens occur sporadically in some years in some areas, particularly where exceptionally high humidity prevails. However, leaf diseases are generally not thought to be the most serious group of diseases on sorghum. Gray leaf spot, anthracnose, and sooty stripe are considered the most important leaf diseases in Africa below 1000 m elevation. These diseases plus northern leaf blight are the most common at higher elevations.

Many African sorghums show some resistance to leaf diseases, and this may be one reason these diseases presently are of so little importance. Introduced material is often completely defoliated. Relatively low plant populations and separation of plants of the same species through the practice of intercropping may also be factors which restrict the development of leaf diseases.

2. Smuts and rust

All four smuts commonly associated with sorghum occur in Africa.

Because relatively little seed is treated before planting, covered smut can be serious and is the most common of the smut diseases on the continent. Yield losses of over 50% reportedly occur in some fields in some years, but average losses on the continent range from 3 to 7%. In dry areas with rainfall of less than 25 inches, long smut is the next most serious disease. However, this disease is not observed in high rainfall areas. Long smut rarely causes yield losses of over 10% within any given field, although it is not uncommon to find all panicles within a field infected. Head smut is generally more common in wet than in very dry areas. A high incidence is sometimes reported in very localized situations. Loose smut appears to be common, but never severe. In Africa, both East and West, it is predominantly found on tillers and not primary heads.

Little attention has been given to physiologic specialization. Two new races of Sphacelotheca sorghi have been reported in S. Africa. In several years of trials, Nigerian isolates have resembled Race 4. With S. cruenta, Nigerian isolates generally have a virulence pattern similar to Race 2. The Nigerian races of S. reiliana do not resemble the North American races.

Rust is of little consequence in Africa. Along the coasts in Sudan and Tanzania a high incidence of rust sometimes occurs, but attack is generally late and likely does not significantly reduce yield.

3. Downy mildews

It is surprising that these diseases are not more important in Africa. Sclerospora graminicola is serious on pearl millet throughout most of West and Central Africa, but not on sorghum. S. sorghi is the

only downy mildew organism reported on sorghum in Africa, and it has caused up to 40% yield loss in isolated areas of both East and West Africa. However, average yield losses due to this disease in Africa probably do not exceed 3%. Local varieties, at least in West Africa, are generally fairly susceptible to downy mildew.

4. Virus and mycoplasm

Sugarcane mosaic has been reported in East and South Africa, but it generally is not considered serious on sorghum. There is little definite evidence for the presence of other virus diseases, and certainly none to classify this group of diseases as important on sorghum.

5. Root and stalk rots

This area of sorghum pathology has received relatively little attention in Africa. Fusarium stalk rots are likely the most serious. There are stalk and root rots which have not been described. They occur rather sporadically and are often, though not necessarily, associated with drought stress. Charcoal rot is present in most of the drier areas of sorghum cultivation. Fields with over 75% yield loss due to charcoal rot, occur in localized situations. A sheath rot believed to be caused by F. moniliforme can lead to stalk rot and is commonly found in many parts of West Africa.

6. Head and seed diseases

In drier areas, sorghums are usually of the photosensitive type, which produce grain after the rains have stopped and humidity is low. In these areas, there is generally little damage due to head and seed molds. However, in more humid areas where sorghum frequently matures under rainy conditions, head and seed molds can seriously reduce grain

quality. In such areas, the human population is generally not as completely dependent on sorghum for food, and a higher proportion of the sorghum grain is used for brewing. Species of Alternaria, Curvularia, Aspergillus, Fusarium and Phoma are the most common species found on grain.

Ergot can be serious in localized areas in certain years in both East and West Africa but of minor importance in looking at entire Africa.

7. Seedling blight

These appear to be of little consequence in Africa at present. Farmers generally overplant and then adjust the stand by thinning. Weaker seedlings are eliminated during thinning.

8. Nematodes

Nematodes appear to be of little consequence, but these parasites have not been studied in depth on sorghum in Africa.

9. Parasitic plants

Both Striga hermonthica and S. asiatica occur and severely reduce sorghum yields. S. hermonthica is the predominant witchweed species along the equator and areas north, whereas S. asiatica is most common in the southern part of the continent. When classified as a disease, witchweed causes the most serious disease problem in sorghum throughout the continent.

Sorghum Diseases in India

In India, sorghum or 'Jowar' occupies 18.7 million hectares of which less than 5 per cent is grown under irrigation. Yield during the past 10 years has remained at about 500 kg/hectare in spite of the

introduction of high yielding varieties and hybrids over the last 8 years. However, these high yielding varieties occupy only about 5% of the 'Jowar' under cultivation.

Many factors contributing to the low production include the lack of timely rainfall, inadequate fertilization and improper crop management. In areas under well distributed rainfall or under irrigation a number of diseases reduce yield. Diseases like sugary disease, ear molds and downy mildew assumed serious proportions with the cultivation of high yielding varieties and hybrids in India.

1. Foliar Diseases, rust and smuts

A number of leaf spot diseases either alone or in combination lead to direct or indirect loss in quantity and quality of grain and fodder sorghum. All of them do not occur in all locations. In Southern and parts of Central India the damage by rust especially in juicy types of sorghum is considerable. It was estimated that the rust alone could contribute to a loss of about 23% in grain yield particularly when the infection starts before boot leaf stage.

Next to rust, leaf blight is very important since it is widespread and a large number of cultivars are susceptible to this disease. The other leaf spot diseases of economic importance are anthracnose, gray leaf spot, sooty stripe, and rough leaf spot.

There are four kinds of smuts attacking sorghum of which covered kernel smut and loose smut cause considerable loss in both grain and fodder sorghum varieties. These smuts are known to be present in all sorghum growing areas in India. In Madhya Pradesh the covered kernel smut causes losses in grain yield varying from 5-30%. Also, it is

especially severe in Northern India on fodder sorghums.

2. Downy mildew

Sorghum downy mildew is becoming increasingly important particularly in South and Central parts of India both in grain and fodder varieties. It is especially severe in years when continuous precipitation occurs during the early stage of the crop. During 1972-73 the disease was widespread in parts of Mysore and Tamil Nadu where the rainfall was very favorable for disease spread. A similar situation prevailed in Andhra Pradesh and parts of Maharashtra during 1971-72. In parts of Mysore the situation is endemic in areas where there is assured rainfall during summer (kharif) and winter (rabi).

Among the released hybrids CSH-1 will develop up to 20% infection whereas CSH-2 and CSH-3 are moderately resistant with infection up to 5%. PSH-2 is moderately susceptible occasionally manifesting 13% infection. Among the hybrids under advanced yield trails, tested under field conditions, none are completely free from downy mildew.

Crazy-top of sorghum, was first observed in India at Coimbatore during October, 1970, and later in April, 1971, at Hyderabad. It is possible that the disease is also prevalent in other parts of the country.

3. Head and seed diseases

Another major problem in sorghum is sugary disease which was first recorded from India in 1917 on local sorghums. In view of the nature of infection which occurs only through stigma or piercing the ovary wall, direct control methods with fungicides has limitations. This fungus has become especially severe in areas where sorghum is grown

during comparatively cooler months with high humidity coinciding with flowering especially in seed production plots where susceptible male steriles are used. The infection can take place either prior to fertilization or 2 to 3 days after the ovaries are fertilized.

Head molds cause a great concern in parts of Maharashtra, Andhra Pradesh, Mysore and part of Tamil Nadu where delayed monsoon favors moldy grains. A large number of saprophytic and a lesser number of parasitic organisms are associated with head molds. They are responsible both for reduction in market value of the grain as well as poor germination and preemergence death. It is also possible that some of the mold infection might lead to the presence of harmful mycotoxins. Most of the popular hybrids and varieties under cultivation are not free from molds.

Sorghum Diseases in North America

More than 80% of the sorghum in the United States is grown as dwarf grain types on the semi-arid plains of Texas, Kansas, Nebraska and Oklahoma. While the average production from these areas is about 5,000 kg/hectare, many fields under irrigation will exceed 10,000 kg/hectare. Dramatic advances in grain sorghum production have resulted from the development of high yielding dwarf hybrids. This fact has also contributed to the typical disease patterns in North America.

1. Foliar diseases

Along the Gulf Coast and in Northern Mexico, nearly all of the common foliar pathogens appear each year. Other than anthracnose during the summer along the Gulf Coast and Helminthosporium blight in Eastern Mexico during the winter months, these diseases have little

known affect on yield. Gray leaf spot and bacterial stripe will commonly develop in all sorghum growing areas, whereas zonate leaf spot develops only in the warmer regions and sooty stripe and Helminthosporium blight generally develop more commonly in the cooler regions. As expected the severity of these diseases increase during wet years and in areas with high sorghum residues.

2. Rust and smuts

Rust is known to be damaging during winter months in Mexico and to fall crops of sorghum in Southwestern Texas. Since it develops slowly and under relatively cool conditions, it does not cause measurable yield losses. Of the four smuts of sorghum, only head smut has remained as a menacing disease. During the late 1950's head smut caused grave losses in several growing regions. These early hybrids were replaced by resistant ones and by 1968, a new population of smut developed that forced introduction of other sources of genetic resistance. During 1972 and 1973, buildup of yet new races of Spacelothica reiliana has occurred. The kernel smuts, probably because nearly all planting seed is treated, are virtually non-existent. Occasionally, a field of "red top cane", grown from a farmer maintained seed lot of a sweet sorgo, will have a high incidence of covered kernel smut.

3. Downy mildews

Both crazy top and sorghum downy mildew have caused damage to grain sorghum in South Texas. During the past 10 years, sorghum downy mildew has spread throughout this area and probably accounted for all time high losses during 1973. Many fields with 80% of the plants systemically infected were common. Sclerophthora macrospora infects plants in an occasional field following flooding. While important to

those growers with damaged plants, it is relatively unimportant economically.

4. Viruses

Of the virus diseases, only maize dwarf mosaic (MDM) is widely prevalent and damaging. In 1967, the MDM spread across the great plains for the first time and substantially contributed to a rapid conversion from very susceptible to MDM tolerant hybrids. Late infection by Maize dwarf mosaic virus is reported to enhance or to have caused reduced seed size "small seed" in sorghum. The other virus and mycoplasms reported in sorghum are presently economically insignificant.

5. Root and stalk rots

Milo disease caused by Periconia circinata, nearly destroyed the young sorghum industry in the U.S. until resistant varieties were developed. Charcoal rot and the similar Fusarium stalk rot have generally been considered the most damaging diseases of North American grain sorghum. During the past two years, a newly observed Pythium root rot appears to be increasing in severity and may become yet another threatening disease.

6. Head and seed diseases

Naked sorghum heads are subject to damages by common seed infesting and infecting fungi under conditions virutally identical with those found in Africa and India. These diseases can cause major losses particularly during prolonged rainy weather following grain maturity. In the principal sorghum growing region of North America we normally anticipate favorable weather for sorghum harvest; however in three of the past nine years, both head blight and seed mold were prevalent.

7. Seedling blight

Seedling blight, damping off and other seedling diseases rarely affect production based on observations in Texas. Even with fairly high stand losses, because of Pythium root rot during cool wet springs or Cercospora sorghi infection of seedlings, the remaining plants compensate for those lost.

8. Nematodes

Nematodes occur on sorghum in damaging populations, and on a few sites yield increases have been observed following nematocide treatment. However it is fair to say that nematodes are not generally damaging to sorghum in North America.

9. Parasitic plants

Parasitic plants are not known to affect sorghum in the major growing region of North America.

Major differences among diseases between the temperates and tropics are few. Long smut occurs in Asia and West Africa. While the disease is relatively insignificant in the tropics, we wonder what it could do in the temperates? Covered kernel smut ranks as a major disease in both India and many parts of Africa, yet it has been virtually eliminated from North America, almost exclusively, because of the practice of seed treatment.

The sugarcane mosic virus diseases occur throughout the world in sorghum. In both Australia and North America serious losses by strains of these viruses are common. The intensification of damage by maize dwarf mosaic virus at cool temperatures probably accounts for it and related strains to be more serious in the temperate regions.

Witchweed (Striga spp.) in so far as sorghum is concerned, causes a major disease only in the tropics. Considerable research on control of these pathogens is needed. Another disease, limited as of yet to the tropical regions of Asia and Africa is sugary disease (Sphacelia sorghi). Recent observations suggest that there are highly specific interactions among sorghum genotypes both in sterile and normal cytoplasm for susceptibility to this disease, although, it was once believed to be serious only on the sterile sorghums.

In the warmer, semi-arid regions of the world sorghum has had surprisingly few disease problems. Those of consequence follow the normally anticipated soil-seed or vector borne pathogens. In these drier regions air and water borne pathogens are only potential hazards.

Certain diseases appear to be common to most regions. These include the stalk rots, virus diseases and some foliage diseases.

Seed molds, head blights and related weathering at times plague sorghum within all regions. Early monsoons in Andhra Pradesh and Mysore, India, summer rains in Texas or cool wet autumns on the Great Plains at times reduce seed quality, test weight and yields.

Of the foliage diseases perhaps rust, Helminthosporium blight, gray leaf spot, sooty stripe and rough spot cause minor yield losses. Although the tropical and semi-tropical winters both rust, Puccinia purpurea and Helminthosporium blight (H. turcicum) appear to cause considerable yield losses. H. turcicum has the potential to become a "southern corn leaf blight" of sorghum in any region of the world.

In a report filed from India, during 1972, sorghum production losses caused by sorghum downy mildew (Sclerospora sorghi) are con-

tributing to famine. Sorghum downy mildew, of the three downy mildews of significance to sorghum, occurs in both temperate and tropical regions. Sorghum downy mildew, however is not important in the tropical highlands. Crazy top downy mildew occurs in all temperate, sub-tropical and tropical regions but generally the disease is of minor importance.

During the past 10 years, hybrid seed production of sorghum developed during the 1950's has spread throughout the world. It appears to us that with the introduction of dwarf high yielding hybrids, epidemic disease cycles similar to those in North America will find their way to Asia and Africa. This simply means that with the increased production, more uniformity in host populations, yield losses can be more easily assessed and witnessed.

Even today, most, if not all sorghum hybrids in the U.S. utilize the original sources of cytoplasmic male sterility. Furthermore, it is estimated that nearly 70% of the sorghum grown derived their pollenator parents (male source) from the same or closely related selections of yellow endosperm lines. Consequently we find ourselves in an unusually vulnerable situation. Recognition of this problem has also stimulated additional efforts toward detecting new sources of resistance to diseases.

Disease resistance characters of sorghums by type and from regions, have been suggested by several workers. For example, many of the Caudatums possess high levels of foliar disease resistance as do many of the Zerazeras from East Africa. Others have noted that sorghum lines from South Africa (Cafforus) have a higher frequency of downy mildew resistance than those from other areas.

In 1957, the assembly of a world collection of sorghums was initiated in India. The world collection of about 4,500 entries was evaluated for disease reactions in India, Africa and now in part in the United States. Data on reactions of each world collection entry for several diseases has been summarized in India and Africa.

However in the U.S. we are unable to evaluate the exotic sorghums because they fail to flower under our long days. Consequently, another vital step in the utilization of sorghum germ plasm was initiated in 19[illegible]. The Texas [illegible]icultural Experiment Station along with the United States Department of Agriculture began selectively converting many sorghums within the world collection to early maturity, long day dwarf types. In the process of conversion selected groups of sorghum lines with superior resistance to various diseases are being found.

During the past two years several hundred exotic lines evaluated as possessing multi-disease resistance in India, were grown in South Texas, U.S.A. In a relatively high frequency (nearly 15%) these same sorghum entries reacted similarly in Texas. Previously non-evaluated sorghums recently added to the world collection, had a lower frequency of multi-disease-resistant lines (4%). In these and other trials, such as the International All-Disease Nursery, the International Sorghum Virus Nursery, the Uniform Head Smut Nursery, and the International Downy Mildew Nursery - all recently initiated, suggest that improvement in levels of disease resistance for sorghum can be achieved through cooperative international programs.

Table 1. The relative prevalence[a)] and importance[b)] of sorghum diseases of the world.

Disease	Temperate	Sub-tropical	Tropical Highland 1000+M	Tropical Lowland Winter 1000(-)M	Tropical Lowland Summer 1000(-)M
	(Outside 34° lat.)	(Within 34° lat.)	(Within 23.15° lat.)		
I Foliar diseases					
Leaf blight (*Helminthosporium turcicum*)	++ 2	++ 1	++ 2	+++ 3	++ 1
Target leaf spot (*H. sorghicola*)	- 0	+ 1		+ 1	+ 1
Anthracnose (*Colletotrichum gramincola*)	+ 1	++ 2			++ 2
Grey leaf spot (*Cercospora sorghi*)	+ 1	+++ 2	++ 2	+++ 3	+++ 2
Zonate leaf spot (*Gloeocercospora sorghi*)	- 0	+++ 2		+ 1	++ 2
Sooty stripe (*Ramulispora sorghi*)	++ 2	++ 2		- 0	++ 3
Rough spot (*Ascochyta sorghina*)	- 0	+++ 2		- 0	+++ 2
Leaf spot (*Ramulispora sorghicola*)	- 0	+ 1		- 0	++ 1
Leaf spot (*Phoma insidiosa*)	+ 1	+ 1		- 0	++ 1
Bacterial leaf stripe (*Pseudomonas andropogoni*)	++ 2	+++ 2	++ 1	+ 1	+ 1
Bacterial leaf streak (*Xanthomonas holcicola*)	+ 1	+ 1		+ 0	+ 0
Bacterial leaf spot (*Pseudomonas syringae*)	+ 1	+ 1	++ 2	+ 0	+ 0
II Smuts and rusts					
Head smut (*Sphacelotheca reiliana*)	++ 2	+++ 3	++ 2	+ 1	++ 2
Loose smut (*Sphacelotheca cruenta*)	+ 1	+ 2	+ 1	+ 0	
Covered smut (*Sphacelotheca sorghi*)	+ 1	+ 1	++ 3	++ 3	++ 3
Long smut (*Tolyposporium ehrenbergii*)	- 0	- 0			+ 1
Loose smut (*Sphacelotheca holci*)	+ 1	++ 2	+ 1	+ 1	+ 1
Rust (*Puccinia purpurea*)	++ 1	++ 2	++ 2	+++ 3	+ 1

Page 2. Table 1. The relative prevalence and importance of sorghum diseases of the world.

	Disease	Temperate (Outside 34° lat.)	Sub-tropical (Within 34° lat.)	Tropical Highland 1000+M (Within 23.15° lat.)	Tropical Lowland Winter 1000(-)M (Within 23.15° lat.)	Tropical Lowland Summer 1000(-)M (Within 23.15° lat.)
III	Downy mildews					
	Sorghum (*Sclerospora sorghi*)	++ 2	+++ 3	+ 1	++ 2	+++ 3
	Graminicola (*S. graminicola*)	+ 1	+ 1	?	+ 1	
	Philippine (*S. philippinensis*)	- 0	- 0	- 0		+ 0
	Sugarcane (*S. sacchari*)	- 0	- 0	- 0		
	Crazy top (*Sclerophthora macrospora*)	++ 2	++ 2	+ 1		
IV	Virus and Mycoplasm					
	Maize dwarf mosaic	+++ 3	+++ 3			- 0
	Sugarcane mosaic (s)	+ 1	++ 2			+ 1
	Corn stunt	+ 1	+ 1			- 0
	Brome grass mosaic	+ 1	+ 1			- 0
	Cucumber mosaic	+ 1	+ 1			- 0
V	Stalk rots and root rots					
	Fusarium stalk rot	++ 2	+++ 3			++ 2
	Charcoal rot	++ 2	+++ 3			++ 2
	Red rot (anthracnose)	++ 2	+++ 3	+ 1	+ 1	++ 2
	Rhizoctonia stalk rot	+ 1	+ 1			+ 1
	Milo disease	+ 1	+ 1			- 0
	Pokkah-bong	+ 1	++ 2	+ 1	++ 3	+ 1
	Pink root	+ 1	+ 1			- 0
	Pythium root rot	++ 2	+++ 3			?

Page 3. Table 1. The relative prevalence and importance of sorghum diseases of the world.

Disease	Temperate	Sub-tropical	Tropical Highland 1000+M	Tropical Lowland Winter 1000(-)M	Tropical Lowland Summer 1000(-)M
	(Outside 34° lat.)	(Within 34° lat.)	(Within 23.15° lat.)		
VI Head and seed diseases					
Head blight (seed mold)	++ 2	+++ 3	++ 2	++ 3	++ 2
Weak neck	+ 1	+ 1			- 0
Sugary disease (*Sphacelia sorghi*)	- 0	- 0			++ 2
VII Seedling blight					
(Species of *Pythium*, *Fusarium*, *Rhizoctonia* & *Helminthosporium*)	+ 1	++ 2	+ 1	+ 1	++ 1
VIII Nematodes					
Pratylenchus spp.	+ 1	++ 2			?
Meloidogyne spp.	+ 1	+ 1			?
IX Parasitic plants					
Witchweed (*Striga asiatica*, *S. hermonthica*)	+ 1	+ 1	++ 3		++ 3 ++ 3

a) Prevalence:
- \- Not reported present
- \+ Occasionally present
- ++ Commonly present
- +++ Generally found on most plants in most fields.

b) Importance:
- 0 Causing no loss
- 1 Minor importance
- 2 Moderate importance
- 3 Representing a major deterrant, at times to crop production.