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Dyer, a New Nematode-Resistant Soybean Variety

University of Tennessee Agricultural Experiment Station

James M. Epps

Edgar E. Hartwig

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Dyer, a new NEMATODE-RESISTANT Soybean Variety

by
James M. Epps
Edgar E. Hartwig

John A. Ewing, Director
The University of Tennessee Agricultural Experiment Station / Knoxville
cooperating with
Crops Research Division / Agricultural Research Service / U.S. Department of Agriculture

SUMMARY

Dyer, a new Soybean cyst-nematode-resistant variety, is adapted to the cyst-nematode-infested areas of Tennessee. Dyer produces high yields in fields in which this nematode occurs. It also has resistance to southern and cotton root-knot nematodes.

Dyer matures approximately 5 days later than Hill, and 18 to 24 days earlier than Pickett. Protein and oil content is similar to Hill. Seeds are approximately 10% larger than those of Hill. Dyer is more susceptible to phytophthora rot than Hill and is resistant to bacterial pustule.

Where cyst and root-knot nematodes are not a problem, Dyer has no advantage over Hill, a variety of the same maturity which is now recommended. Because of its earlier maturity, Dyer can be grown where Pickett is too late maturing. A combination of the two cyst-nematode-resistant varieties differing in maturity will aid in spreading the harvest season for the large grower with a nematode problem.

The soybean cyst nematode occurs in most of the counties west of the Tennessee River, and it has been reported in Humphreys County east of the river. Since its discovery in Tennessee (1956), new infestations have been reported each year. The cyst nematode may be present but not yet discovered in other areas of the State. Planting productive varieties resistant to the nematode is an efficient method of control. Dyer resulted from a research program to develop adapted varieties to meet the needs of soybean producers in the cyst-nematode-infested areas.

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ACKNOWLEDGMENT

Grateful acknowledgment is made to the Soybean Oil Mill Operators in Lake County, Tennessee for leasing one-half of the test area for the studies; to the Tennessee Agricultural Extension Agents for arranging the demonstration plantings; to the growers for conducting the tests; to the cooperators of the Uniform Soybean Tests in the Southern States; to the superintendents of branch stations; to members of the Department of Agricultural Biology; and to the Agronomists who conducted yield evaluations.

DYER, NEW NEMATODE-RESISTANT SOYBEAN

by

James M. Epps [1]

and

Edgar E. Hartwig [2]

Dyer is a new soybean variety released in March, 1967, by the Tennessee Agricultural Experiment Station, Missouri Agricultural Experiment Station, and Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture.

The new variety has excellent resistance to the soybean cyst nematode,[3] and good resistance to southern root-knot [4] and cotton root-knot nematodes.[5] It is not as resistant to phytophthora rot [6] as the Hill variety but is resistant to bacterial pustule,[7] a common foliar disease of soybeans. It was evaluated experimentally as D63-7320.

DESCRIPTION

Dyer makes medium growth similar to the Hill parent. Plants have purple flowers and tawny pubescence. Seeds are yellow with black hila and are larger than those of Hill. It matures approximately October 5-15 or 5 days later than the Hill variety and 18

[1] Nematologist, Nematology Investigations, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and Associate Professor of Plant Pathology, Tennessee Agricultural Experiment Station, Jackson, Tennessee.

[2] Research Agronomist, Soybean Investigations, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, Stoneville, Mississippi.

[3] Caused by *Heterodera glycines* Ichinohe, 1952.

[4] Caused by *Meloidogyne incognita* (Iofoid & White) Chitwood, 1949.

[5] Caused by *Meloidogyne incognita* acrita Chitwood, 1949.

[6] Caused by *Phytophthora megasperma* var. *sojae.*

[7] Caused by *Xanthomonas phascoli* var. *sojensis.*

to 24 days earlier than the Pickett variety. It has not held its seed as well as Hill, but will hold them satisfactorily for at least 3 weeks after reaching combine maturity. Protein and oil content of the seed is similar to that of Hill. It is more susceptible to phytophthora rot than Hill and has resistance to bacterial pustule, a common foliar disease of soybeans. In addition to resistance to the soybean cyst nematode, Dyer has good resistance to the two root-knot nematodes which are common parasites in many areas.

ORIGIN AND DEVELOPMENT

Dyer originated from a cross made in 1960 between Hill and a black-seeded cyst nematode resistant selection from Lee x (Lee x Peking). The objective was to obtain a productive yellow-seeded soybean resistant to cyst nematodes. In 1960-61, the first-generation plants were grown in the greenhouse at Stoneville, Mississippi. Later in 1961, approximately 2,400 second-generation plants were grown in cyst-nematode-infested soil in the greenhouse at Jackson, Tennesee. Plants with no cysts were transplanted to field plots at Ridgely, Tennessee, and grown to maturity. Seeds from each plant were planted in cyst-nematode-infested soil at Jackson to recheck for resistance.

In 1962, six apparently resistant third-generation lines were grown in the field at Stoneville for field evaluation. One line consisting of 17 plants was yellow-seeded. These were again checked for cyst nematode reaction in the greenhouse at Jackson, and one plant produced all resistant progeny. In 1963, fifth-generation yellow-seeded lines from this plant were grown in the field at Stoneville, and after harvest they were rechecked for cyst nematode reaction in the greenhouse at Jackson. During the winter of 1963-64, sixth-generation lines were grown for increase at Mayaquez, Puerto Rico.

In 1964, lines were field-tested for cyst nematode reaction at Clayton, North Carolina; Ridgely, Tennessee; and Portageville, Missouri. The lines were grown for yield evaluation at Stoneville and Portageville in absence of cyst nematodes and at Ridgely in cyst-nematode-infested soil. A seed increase plot was planted at Stoneville. Dyer was further evaluated at 30 locations in the Uniform Soybean Tests in the Southern States during 1965 and 1966.

Approximately 100 bushels of breeders' seed were produced at Jackson in 1965. Seed stocks were increased by appropriate foundation seed organizations in Tennessee and Missouri in 1966. These seeds will be used to increase the variety in 1967, and growers should be able to obtain seed for planting in 1968.

NEMATODE RESISTANCE

Soybean Cyst Nematode

Dyer has been field-tested in plots in which cyst nematodes had caused heavy losses to susceptible varieties in previous years (Figure 1). Yield data obtained in heavily-infested plots are shown in Table 1.

Table 1. Yield and oil and protein content of Dyer and Hill grown in cyst-nematode-infested field plots, Ridgely, Tennessee, 1964-66

	Yield (Bushels per acre)				Avg. percent (3 yrs.)	
Variety	1964	1965	1966	Avg.	Protein	Oil
Hill	32.2	25.1	34.3	30.5	40.8	21.3
Dyer	46.8	37.7	43.2	42.6	40.6	21.2
LSD (.05)	4.5	3.2	4.3	4.0	N.S.	N.S.

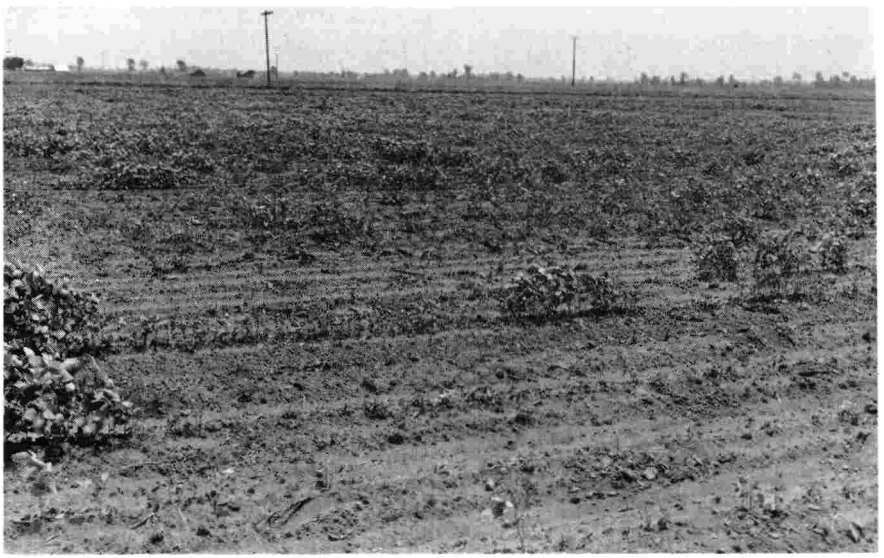

Figure 1. A view of the plot area at Ridgely, Tennessee, on which most of the tests were conducted. Note severe damage to susceptible plants caused by the soybean cyst nematode.

Dyer produced an average of 12.1 bushels more per acre than Hill in these tests. Calculated at $2.80 per bushel, this amounts to $33.88 more per acre per year for the Dyer variety.

A count was made of the nematode populations in soil samples collected from the plots after a crop of Dyer and Hill soybeans. These results and root ratings are shown in Table 2.

Table 2. Field population of cyst nematodes in soil and ratings of nematodes on the roots, Ridgely, Tennessee, 1964-66

	Nematodes per ½ pt. soil				Root Ratings		
Variety	1964	1965	1966	Avg.	1964	1965	1966
Hill	152	216	267	212	4[1]	4	4
Dyer	0	8	3	4	0	0	0

[1] Ratings are based on a scale of 0—4. 0=no white females per root system and 4=100 or more.

In 1966, Dyer was included in yield tests at Martin, Spring Hill, and Jackson, Tennessee. One of the tests at Martin was on cyst-infested soil and the other was on soil free of cyst nematodes. The test at Spring Hill was on soil free of cyst nematodes. The test at Jackson was in a field where the previous soybean crop had been damaged severely by cyst nematodes. Yield data for the four tests are shown in Table 3. Differences in growth of Dyer and Hill when grown in heavily-infested soil are shown in Figures 2 and 3.

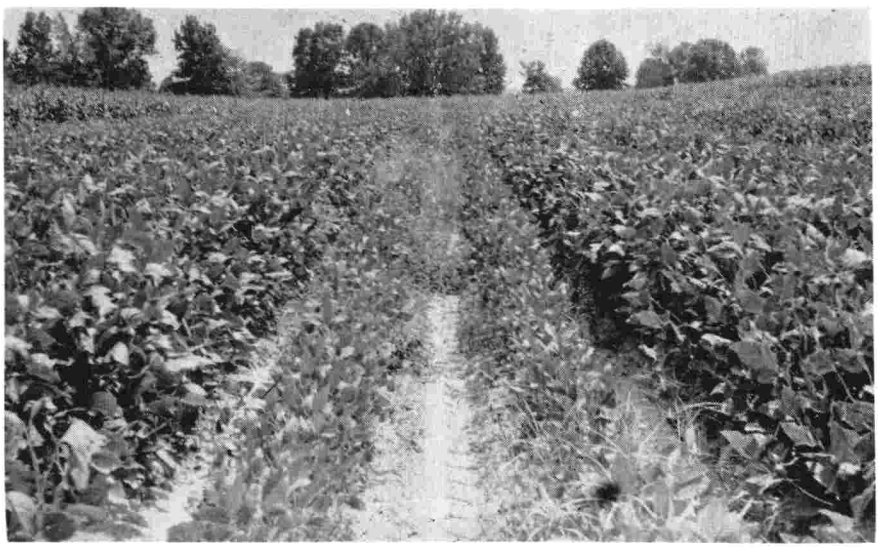

Figure 2. Two center rows are Hill which produced an average of 5.4 bushels per acre. Plots on either side are Dyer which produced an average of 23.8 bushels per acre. Kenton, Tennessee, 1965.

Table 3. Yield in bushels per acre of Dyer and Hill in tests in Tennessee, 1966

	Soil without cyst nematodes		Soil with cyst nematodes	
Variety	Spring Hill	Martin	Jackson	Martin
Hill	47	48	32	22
Dyer	44	48	36	30
LSD (.05)	N.S.	N.S.	N.S.	5.0

Figure 3. Left: Hill variety showing much less growth due to a heavy infestation of cyst nematodes on the roots. Right: A row of Dyer (D63-7320) showing vigorous growth in soil heavily-infested with the soybean cyst nematode.

Southern and Cotton Root-Knot Nematodes

Dyer has good resistance to two root-knot nematodes which are widespread and may occur in many soybean plantings. It is not uncommon to find either of these parasitizing soybeans in fields infested with cyst nematodes, and where root-knot and cyst nematodes occur together, damage is very severe.

Hill soybean has good resistance to these root-knot nematodes, and the resistance in Dyer is from this parent.

Dyer has been grown in the greenhouse and in field plots to determine its resistance to these two root-knot nematodes. The results of some of these tests are shown in Table 4.

Table 4. Reaction of Dyer, Hill, and Lee (susceptible) to the two kinds of root-knot nematodes, Jackson, Tennessee, 1964-66

	Southern root-knot			Cotton root-knot		
Variety	1964	1965	1966	1964	1965	1966
Hill	1.0[1]	1.0	0.7	1.0	0.7	0.8
Dyer	1.0	1.0	0.6	1.0	0.9	0.6
Lee (susceptible)	4.0	4.0	4.0	4.0	3.5	4.0

[1] Ratings based on 0 to 4. 0 indicates no knots on the roots while 4 indicates that 75-100% of the roots contained visible knots.

DISCUSSION

Dyer is recommended primarily for production where losses from soybean cyst, southern root-knot, and cotton root-knot nematodes occur. In the absence of these nematodes, Dyer has no advantage over the recommended varieties (Hill, Hood, Lee, Ogden). Dyer is not recommended for heavy, poorly-drained soils because of its lower degree of resistance to phytophthora rot. The nematodes appear to cause more damage in the coarse-textured soils where little damage is expected from phytophthora rot.

Seed yield and quality of Dyer has been very good in tests in Tennessee. In addition to the results obtained in the replicated plantings, Dyer was grown in 14 strip tests in 6 West Tennessee counties in 1966. Losses from cyst nematodes had been recognized

on each of these fields in previous years. The average yield of Dyer in these fields was 32.2 bushels per acre, and for Hill it was 18.5 bushels. Dyer is considered a well adapted variety for production where the three kinds of nematodes are a problem and its maturity is suitable.

A comprehensive program is underway to combine resistance to phytophthora rot with resistance to these nematodes. A variety with this type of resistance is more desirable because it could be grown over a wider range of disease conditions.

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