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Castorbean production in the Mississippi Delta

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Conclusions

Extremely high yield losses from capsule drop during the period of 1957 through 1962 indicate that this disease must be controlled if castorbeans are to become a commercial crop in the Mississippi Delta and surrounding area. The development of disease-resistant varieties is considered the best method of controlling this disease. It is believed that resistant varieties may be available in the near future.

Early harvesting, before capsule drop causes severe yield losses, may be a satisfactory method of controlling this disease and producing this crop. By chemically desiccating and harvesting castorbeans in late September or October, satisfactory yields of over 2000 pounds of seed per acre were obtained in most tests from 1959 through 1962. It is suggested that selecting a high-yielding variety or hybrid and desiccating before capsule drop causes severe yield losses may be a profitable method of producing castorbeans in the Mississippi Delta and surrounding area until resistant varieties are available.

Producers should make definite arrangements to harvest and sell the crop before planting castorbeans.

Table 1.—Yields of 24 varieties and hybrids of castorbeans harvested from border and yield rows on different dates at Stoneville, Mississippi, in 1959.

Variety or hybrid	Average yield (pounds of seed per acre)				Yield losses from capsule drop (%)
	Border rows harvested by			Yield rows harvested	
	8/12	8/27	10/26	11/12	
T58081	1707*	2298*	2475*	1419*	57.3
T58078	1700*	1958*	2006	920	54.1
T58082	1491*	1901	1971	675	65.8
T58085	1497*	2141*	2309*	1262*	45.3
T58087	1436*	2101*	2346*	1399*	40.4
T58079	1280	2156*	2278*	1085*	52.4
T58086	1231	2011*	2134*	1413*	33.8
T58088	1226	1817	1994	994	50.2
T58094	1165	2056*	2289*	790	65.5
T58098	1132	1801	1967	834	57.6
T58093	1074	1863	2130*	653	69.3
T58089	1067	1768	1947	599	69.2
T58089	1047	1602	1748	646	63.0
T58092	1030	1752	1954	788	59.6
T58095	1005	1708	2028	650	67.9
T58097	907	1776	2016	1041*	48.4
T58080	891	1842	1998	1022*	48.8
T58096	859	1745	1931	716	62.9
T58084	783	1768	2104*	1039*	50.6
T58083	736	1675	1879	839	55.3
Baker 296	672	1382	1717	1366*	20.4
Dawn	640	916	1043	656	37.1
Baker 147	611	1378	1656	922	44.3
Interspersed Dawn	499	931	1105	762	31.0
Average	1070	1764	1959	922	52.9
LSD (5%)	303	359	372	422	----
Coefficient of variation, %	20.1	14.4	13.5	32.4	----

*Not significantly different from highest yielding hybrid or variety.

CASTORBEAN PRODUCTION IN THE MISSISSIPPI DELTA

By THOMAS W. CULP[1]

High yields of castorbeans in 1956 variety trials at Stoneville, Mississippi, indicated that this species is potentially a promising new oilseed crop for the Mississippi Delta and surrounding area. Diseases were not a problem that year and 415 hybrids produced an outstanding yield, 3693 pounds of seed per acre. The average yield of 14 varieties and hybrids was 2793 pounds of seed per acre.

These hign yields stimulated much interest in this crop, and Delta farmers planned to plant approximately 1000 acres of castorbeans in 1957 and 1958. Only 100 acres were planted each season because of extremely wet weather at planting time. This was most fortunate because diseases of castorbeans practically destroyed commercial plantings during these two seasons.

Destructive Disease

Capsule drop,[2] and possibly other fungi, proved to be the most severe disease of castorbeans and the limiting factor in the production of this crop in the Mississippi Delta. It was estimated that this disease reduced yields in variety trials by 70 and 85% in 1957 and 1958, respectively. It is apparent from these data that capsule drop must be controlled if castorbeans are to become a commercial crop in the Mississippi Delta and surrounding area.

Capsule Drop Resistant Varieties

The most promising method of controlling capsule drop is the development of disease-resistant varieties of castorbeans. In 1957, it was noted that the variety Baker 296 possessed a high degree of resistance to this disease. MW-1, an ornamental strain which retained its seed throughout the fall and winter, was found near Clarksdale, Mississippi, in March 1958. This line proved to possess a greater degree of resistance to capsule drop than other lines tested. Since Baker 296 has not consistently produced satisfactory yields and MW-1 is a very tall normal-internode line, they were not suited for commercial production in this area. Therefore, it became necessary to transfer the resistance exhibited by MW-1 and Baker 296 to more productive dwarf-internode lines.

Crosses to transfer capsule drop resistance to productive dwarf-internode castorbean lines were made in 1958 and 1959. Progenies from these crosses have been most promising for yield potential and resistance to capsule drop. Experimental lines of the F_4 and F_5 generations of these crosses were first compared in a preliminary variety trial in 1962. Variability was very great in this test, but 5 experimental lines produced statistically greater yields than Baker 296. The highest yielding line produced 2801 pounds of seed per acre. A total of 42 of the 154 selections produced yields numerically equal or greater than that of Baker 296, which produced 1278 pounds of seed per acre.

Although capsule drop was not a major problem in most castorbean plantings in 1962, yield losses in this test were high because the plants were killed by cotton defoliants in October. It was estimated that Baker 296 lost 24.4% of its seed from capsule drop.

This estimate was obtained by harvesting half of each plot as the seed matured in October and November with only minor losses from capsule drop. The remaining half of each plot was harvested in December in the usual manner

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[2]Caused by Alternaria ricini (Yoshii) Hansf

of waiting until the plants were killed by frost. The difference in yields of these 2 harvests was attributed to losses from capsule drop. A total of 51 of the 154 selections lost no more seed than Baker 296, and 14 selections lost less than 10% of their seed from capsule drop.

These data indicate that varieties superior to Baker 296 in yield and capsule drop resistance should be developed from these experimental lines in the near future.

Early Harvest

Other methods of controlling capsule drop of castorbeans have been investigated, and the most promising of these methods is harvesting before this disease becomes a major problem. The first indication that early harvesting might be a method of controlling capsule drop of castorbeans was obtained from the yields of border rows harvested in a yield test at Stoneville, Mississippi, in 1959. Border rows were harvested on August 12, 27 and October 26 to obtain yield estimates without losses from capsule drop.

Harvesting on August 12 is too early for satisfactory yields; however, one hybrid produced 1707 pounds of seed per acre (Table 1). Very acceptable yields of about 2000 pounds of seed per acre were obtained with 7 hybrids, and most of the other varieties and hybrids produced satisfactory yields of over 1600 pounds of seed per acre when harvested on August 27. These yields represent 90% (range = 80.5 to 97.6%) of the total yield of border rows obtained by October 26.

Greater yields of 64.9% (range = 15.2 to 127.6%) were obtained by harvesting on August 27 rather than by waiting until the plants were killed and dried by frost on November 12 (the usual method of castorbean harvest). When the yields of border rows harvested by October 26 are compared with the yields of plot rows harvested on November 12, 52.9% (range = 20.4 to 69.3%) less seed were obtained on November 12, primarily because of losses from capsule drop. Therefore, higher yields were obtained with all varieties and hybrids by early harvest on August 27.

Stands were not as good and castorbeans suffered from lack of moisture in 1960; however, data were obtained that support the results of 1959. Border rows of the 1960 Regional Castorbean Yield Test were harvested first on September 21. The highest yielding variety produced 1992 pounds of seed per acre. This yield was not significantly different from that of the other varieties and hybrids. The average yield of all varieties and hybrids was 1525 pounds of seed per acre.

These yields represent 78.6% (range = 51.7 to 93.4%) of the total yield of border rows obtained by November 11. These values are lower than those obtained in 1959 because many of the 1960 entries flowered and set seed later in the season. However, higher yields of 37.9% (range = -39.6 to 128%) were obtained by harvesting on September 21 rather than by waiting until the plants were killed and dried by frost on November 11.

When the total yields from 2 harvests of border rows are compared with the yields of one harvest of yield plots on November 11, the varieties and hybrids lost an average of 38.9 (range = 14.3 to 62.5%) in yield, primarily from capsule drop. This value was smaller than expected because the resistant varieties MW-1 and Baker 296 were included in this test. Yields of all susceptible varieties were much greater when castorbeans were harvested on September 21.

These data indicate that castorbean yields of about 2000 pounds of seed per acre may be obtained by selecting the most productive varieties or hybrids, desiccating, and harvesting before capsule drop causes severe yield losses.

Chemical Desiccation

Preliminary tests to compare the effectiveness of chemical desiccants and their application to castorbeans were initiated in 1960 in cooperation with R. O. Thomas[3]. Chemical desiccants[4] Diquat. L10, and Drop Dead, with 100 cc of the surfactant Colloidal X77, were applied at the rate of 2 pints per acre to kill and dry castorbeans for harvest. These chemicals were applied with a Hahn Hi-boy equipped with inverted-U defoliation booms to completely spray the plants.

The most effective plant coverage was obtained with an overhead system consisting of 3 flat fan-type herbicide nozzles (Spraying Systems No. 80001) and a horizontal system consisting of 4 (2 on each side of the row) flat fan-type herbicide nozzles (Spraying Systems No. 800067) per row. The spray volume was 15.45 gallons per acre when the machine was operated at 5 m.p.h. and the system was under 30 p.s.i. By use of this method ot applying the desiccants, the castorbeans were usually dry and ready for harvest approximately 2 weeks after application.

Four tests were desiccated with these chemicals—two on September 21, one on October 3, and one on October 10. Most varieties produced satisfactory yields of 1500 to 2000 pounds of seed per acre. Diquat consistently dried castorbeans faster than the other chemicals and was considered to be the best desiccant under study.

When to Desiccate and Harvest

A study to determine the proper time to desiccate and harvest castorbeans for maximum yields without losses from diseases was conducted at Stoneville, Mississippi, in 1961. The 2 varieties Baker 296 and Hale were desiccated with Diquat

[3]Plant Physiologist, Crops Research Division, Agriculture Research Service, U. S. Department of Agriculture, in cooperation with the Delta Branch of the Mississippi Agricultural Experiment Station.

[4]Mention of commercial products or companies does not imply endorsement of or recommendation over others of a similar nature not mentioned. Diquat is 1:1 ethylene-2:2 dipyridylium dibromide. L10 is arsenic acid and sorbatol of which the exact chemical composition was unknown. Drop Dead is 25.2% pentachlorophenol, 3.6% other chlorinated phenols, 40% aromatic petroleum derivative solvent, and 31.2% inert ingredient.

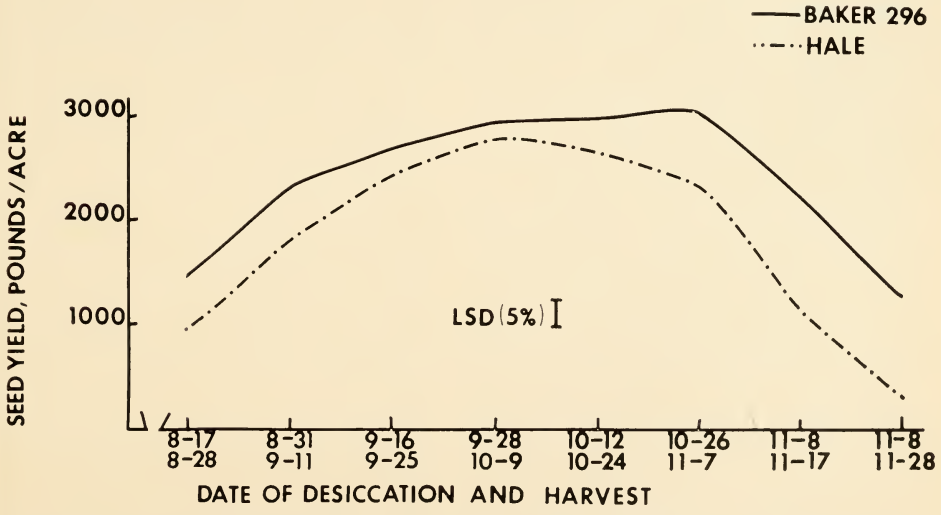

Figure 1. Yields of 2 varieties of castorbeans grown at Stoneville, Mississippi, and desiccated and harvested at various dates from August 17 through November 28, 1961.

at about 2-week intervals from August 17 through November 11. Baker 296 produced its highest yield (3096 pounds of seed per acre) when desiccated on October 26 and harvested on November 7 (Figure 1). This yield was not significantly different from the yields of 2969 and 2993 pounds of seed per acre, which were obtained when this variety was desiccated on September 28 and October 12 and harvested on October 9 and 24, respectively. Satisfactory yields of over 2000 pounds of seed per acre were obtained when this variety was desiccated as early as August 31 or harvested as late as November 17.

The late, susceptible variety Hale produced its highest yield (2829 pounds of seed per acre) when desiccated on September 28 and harvested on October 9. This yield was not significantly different from the yield of 2653 pounds of seed per acre obtained by desiccating on October 12 and harvesting on October 24. Satisfactory yields of 2460 and 2345 pounds of seed per acre were obtained when the plants were desiccated on September 16 and October 26 and harvested on September 25 and November 7, respectively. Yields were greatly reduced when this variety was desiccated and harvested before or after these dates.

These data indicate that excellent yields of both Baker 296 and Hale were produced by desiccating and harvesting in late September and October before capsule drop became a major problem. Susceptible varieties, such as Hale, can be produced satisfactorily by early harvest; however, the time when maximum yields can be obtained is limited to a few weeks. Resistant varieties, such as Baker 296, can be harvested much later in the season, thus eliminating some of the risk in harvesting the crop.

Capsule drop was a major disease problem at Stoneville, Mississippi, late in the 1961 season. The resistant variety Baker 296 lost very few seed before the plants were killed by frost on November 8. Reductions in yield after this date can be attributed primarily to capsule drop. On November 17 and 28 (9 and 20 days after the plants were killed by frost), Baker 296 produced only 2248 and 1271 pounds of seed per acre, respectively. (This was the time when it was impossible to machine harvest because of wet weather.) These data indicate that Baker 296 lost 27% and 59% of its seed from capsule drop during these periods.

Hale began to lose seed from capsule drop after October 9. Reductions in yield of 176, 484, 1711, and 2498 pounds of seed per acre were recorded when this variety was harvested on October 24, and November 7, 17, and 28, respectively. These reductions in yield of 6.2, 17.1, 60.5, and 88.3% can be attributed primarily to capsule drop. Much greater yields were obtained by early harvesting in late September or October.

Similar harvesting studies were conducted at Greenwood, Hollandale, and Stoneville, Mississippi, in 1962. Castorbeans were not chemically desiccated before harvesting. Capsules were harvested green and dried at about 120° F prior to hulling. Although yields were much lower during this season, results support the findings of 1961.

There were no significant differences in yields due to dates of harvest or varieties in the test grown at Greenwood, Mississippi. Average yields of Baker 296, Hale and Hale Hybrid ranged from 1209 to 1300 pounds of seed per acre when harvested at approximately 2-week intervals from September 15 through November 15 (Figure 2). These results indicate no reductions in yields from early harvesting.

The yields of the 3 varieties and hybrids were highly significantly different in the test grown at Hollandale, Mississippi. The early variety Baker 296 produced its highest yield of 1495 pounds of seed per acre when harvested on September 15.

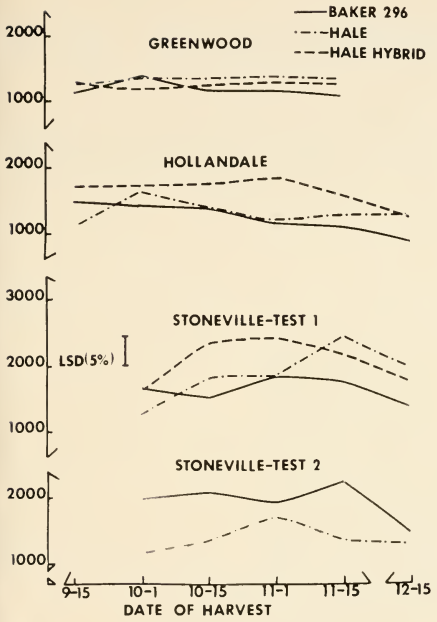

Figure 2. Yields of 3 castorbean varieties and hybrids grown at Greenwood, Hollandale, and Stoneville, Mississippi, and harvested at approximately 2-week intervals from September 15 through December 15, 1962.

Yields declined slightly with each progressive harvest. Hale Hybrid produced its highest yield (1721 to 1812 pounds of seed per acre) when harvested about every 2 weeks from September 15 to November 1. Hale produced its highest yield (1623 pounds of seed per acre) when harvested on October 1.

The first test at Stoneville, Mississippi, was planted on Bosket fine sandy loam on May 10, 1962. Baker 296 produced its highest yields, which ranged from 1500 to 1806 pounds of seed per acre, when harvested approximately every 2 weeks from October 1 through November 15. Hale Hybrid produced its highest yields, which ranged from 2168 to 2416 pounds of seed per acre, when harvested about every 2 weeks from October 15 to November 15. Hale produced its highest yields which ranged from 1972 to 2417 pounds of seed per acre, when harvested about every 2 weeks from November 15 to December 15. This variety produced satisfactory yields of about 1800 pounds of seed per acre when harvested on October 15 and November 1.

The second test at Stoneville, Mississippi, was planted on Dundee silty clay on May 9, 1962. Baker 296 produced 1898 to 2208 pounds of seed per acre when harvested about every 2 weeks from October 1 through November 15. Hale produced its highest yield of 1730 pounds of seed per acre when harvested on November 15. Yields were greatly reduced before or after this date of harvest.

When yields at different dates of harvest for all varieties at all locations are considered, yields of 1496 to 1610 pounds of seed per acre were obtained by harvesting about every 2 weeks from October 1 through November 15. Although Baker 296 may be harvested earlier than Hale and Hale Hybrid, satisfactory yields were obtained with all varieties by harvesting from September 15 through November 1. During most seasons, capsule drop causes severe yield losses after late October; therefore, yields obtained by harvesting on November 1 or later usually would be much less.

Results obtained in 1961 and 1962 suggest that a satisfactory crop of castorbeans should be produced by desiccating and harvesting in late September or October before capsule drop becomes a major problem. A late, susceptible variety such as Hale may be successfully produced; however, the period when maximum yields can be obtained is short. This apparently is true for all susceptible varieties; however, an earlier one such as Hale Hybrid can be expected to produce a greater yield and reduce the hazards of production.

Growing a resistant variety such as Baker 296 also greatly reduces the hazards of castorbean production in this area.

Baker 296 was harvested from October 9 through November 7 without appreciable losses in yield. This variety did not lose seed from capsule drop after being desiccated as readily as the susceptible varieties. It is expected that resistant varieties, when available for production, will produce most satisfactorily in this area if desiccated and harvested before the plants are killed by frost or before diseases become a major problem.

National Production

It is estimated[5] that the United States should be growing more than 150,000 acres of castorbeans annually to meet its needs for castor oil. In 1961 and 1962, approximately 27,000 acres of castorbeans were grown on the Great Plains and in the Far West. The production from this acreage supplies only 10 to 18% of the total annual consumption of more than 120,000,000 pounds of castor oil. In addition, better varieties and hybrids, mechanical harvesting and increased industrial demand for castor oil account for a more competitive position of castorbeans.

Grown Under Contract

Castorbeans are usually grown on a contract basis. There are no acreage restrictions or price supports and castorbeans are not in surplus. Before planting castor beans, a grower should make definite arrangements to harvest and sell his crop.

Seed Price

In 1962, the contract price at planting time in the Plainview area of Texas was 5.25 cents per pound on a clean-seed basis, delivered in Plainview. Market price at time of delivery was 5.08 cents per pound. Growers had the option of a fixed price (5.25 cents per pound) at planting time, or they could elect to receive the market price at time of delivery, with a guaranteed minimum of 5 cents per pound. Prices at other delivery points varied slightly according to differences in freight charges. Prices at East and West Coast plants ranged from 6.3 to 6.5 cents per pound over the past 3 years. Contracts for the 1963 crop assure the market price at time of delivery, but not less than 5 cents per pound.

Toxic Substances

Castorbean seed, as well as the pressed cake or pomace remaining after oil extraction, is poisonous to humans, livestock, and poultry. Toxic substances found in castorbeans are ricin (an albumin or poisonous protein), and ricinine (an alkaloid). The foliage, which is mildly toxic, contains only ricinine. Precautions must be taken in castorbean production and handling. Eating only one seed may produce nausea in humans and could be fatal.

Allergens (separate and distinct from the toxic compounds) also are found in the seed and pomace. Nearly 2% of the seed is composed of allergens, which may cause reactions in some people.

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[5]Brigham, R. D. Castorbeans — Industrial Crop with potential. Crops and Soils 15:12-14. 1963

Brigham, R. D. Castorbeans — An industrial crop with a future. Texas Agricultural Progress 9:33-35, 1963.