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Rapeseed in Alabama

ALABAMA AGRICULTURAL EXPERIMENT STATION AUBURN UNIVERSITY
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RAPESEED IN ALABAMA

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INTRODUCTION

RAPE HAS BEEN GROWN as an oilseed crop for a long time in Europe. It was first grown as an oilseed crop in Belgium and Holland during the 1600's, later spreading into Germany, France, Denmark, Sweden, Poland, and Russia. Rape continued to be an important oilseed crop in Europe with little grown elsewhere in the world, except China and India. After World War I, rape production started in Argentina and Chile in South America. Rapeseed production did not begin in North America until World War II when the crop was grown in western Canada. However, since World War II, rapeseed production has increased rapidly in western Canada. Only in recent years has there been any production of rapeseed in the United States, this mainly in western states adjacent to Canada. In the southern United States, small amounts of rape have been grown for grazing.

DESCRIPTION OF RAPESEED

Winter rape *(Brassica napus)* is a cool season annual that can be planted in autumn and harvested during spring or early summer in regions where winters are not too severe. Summer turnip rape *(Brassica campestris)* is grown as a summer crop in cold climate areas such as western Canada.

Rape belongs to the mustard family, resembling cabbage when young, figure 1, but growing to a height of about 3 to 6 feet. The brilliant yellow flowers produce pods containing 15 to 40 seeds each, figure 2. The black seeds contain 40 to 45 percent oil which has a variety of uses, depending on the chemical composition. Rapeseed can be crushed with the same equipment used for soybeans. Rapeseed oil must be low in erucic acid if it is to be used in edible oil products. Low erucic acid (about 1 percent) varieties have been developed by European and Canadian plant breeders. High erucic

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FIG. 1. Young rape in variety test during late November.

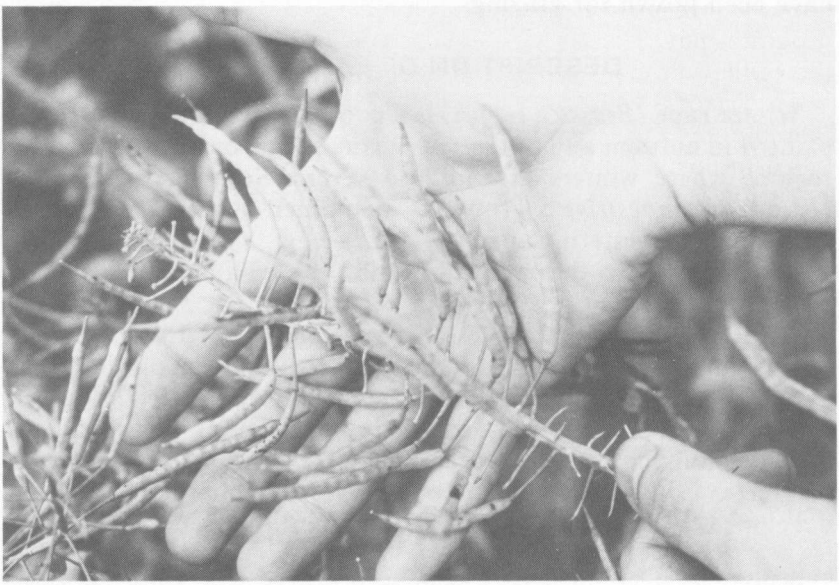

FIG. 2. Green pod of rape in April.

acid (over 50 percent), however, is in strong demand for industrial chemicals used in the rubber industry, textiles, detergents, plastics, and lubricants. Currently, many rapeseed are imported for these uses. The by-product rape meal contains 40 percent crude protein with a good amino acid composition. Rape varieties high in glucosinolates produce meal with reduced palatability and can cause toxicity in poultry and swine when fed in large quantities. Thus, varieties low in glucosinolates are desirable to improve feeding value of the meal.

RESEARCH IN ALABAMA

The need for a winter cash crop suggested that rapeseed might be useful in the Southeastern United States. If rapeseed could be doublecropped on soybean *(Glycine max)* land, it would also serve to reduce soil erosion during the winter months. Research on rapeseed was initiated by the Alabama Agricultural Experiment Station in 1977. This publication reports the results of variety, management, and fertilizer trials in Alabama.

Varieties

A wide range of winter rape varieties has been tested in Alabama, table 1. Most of these are from Europe where rape breeding programs have been active for a long time. In addition to varieties in the table, varieties which winter-killed in Alabama were Torch, Torp, Trico, GW-21, GW-22, and Cyclon, figure 3. Midas, a variety that blooms during February and early March, has also winter-killed in northern Alabama.

Variety trials were conducted at six locations in Alabama. Rapeseed were generally planted in October at the rate of 6 pounds per acre in 12-inch rows. Plots were 5 x 20 feet with four replications. Phosphorus and potassium were applied using soil test recommendations for small grains. Nitrogen was applied at 50 pounds of nitrogen per acre at planting and again in early March. No herbicides were used. Malathion was applied at bloom time for aphid control. Plants were cut when pods were mature and threshed in a small thresher.

Blooming dates, plant height, and pod maturity differed greatly among varieties at the Plant Breeding Unit in central Alabama, table 2, figure 4. Seed yields also differed greatly from year to year as considerable seed were lost by shattering, mainly due to lack of experience in handling this crop, figure 5. If plants had been cut

TABLE 1. ORIGIN AND SEED CHEMICAL CHARACTERISTICS OF RAPE VARIETIES

Variety	Origin	Erucic acid	Glucosinolate
ORB 78-259	Oregon, U.S.A.	High	Low
Dwarf Essex	Holland	Normal	High
Norde	Sweden	Normal	High
Gorczanski	Poland	Normal	High
Bishop	Canada	Low	Low
Herkules	Sweden	Low	Low
Jet Neuf	France	Low	High
Rapora	West Germany	Low	High
Primor	France	Low	High
Sipal	Sweden	Low	High
Quinta	West Germany	Low	High
Brink	Sweden	Low	High
Gullivar	Sweden	Low	High
Solo	Sweden	Low	High
Midas	Canada	Low	High
Garant	West Germany	Low	High

FIG. 3. Rape varieties at left front winter-killed in central Alabama, January 10.

TABLE 2. SEED YIELD OF RAPESEED VARIETIES OVER 3 YEARS AT PLANT BREEDING UNIT, TALLASSEE

	Plant height	Date of 50 percent bloom	Date harvested in 1981	Seed yield per acre			
				1979	1980	1981	Average
	Ft.			*Lb.*	*Lb.*	*Lb.*	*Lb.*
Gullivar	5	March 10	May 7	2,050 a*	560 c	2,070 a	1,560
Dwarf Essex	6	April 20	May 28	820 d	920 b	2,060 a	1,270
Sipal	4	April 5	May 21	-	-	1,830 ab	-
Herkules ...	3	April 10	May 28	-	-	1,800 ab	-
Quinta	6	April 15	May 25	-	1,110 a	1,720 ab	-
Garant	6	April 20	May 25	-	1,290 a	1,580 ab	-
Brink	4	April 5	May 21	1,250 c	610 c	1,270 b	1,040
Solo	3	March 20	May 7	-	-	560 c	-
Midas	4	March 5	-	1,700 b	330 d	-	-
Date planted				Oct. 1	Oct. 10	Oct. 2	

*Any two yields within a column marked with the same letter are not significantly different at 5 percent level.

FIG. 4. Gullivar (left) variety bloomed earlier than Dwarf Essex (right), March 22.

FIG. 5. Rape at nearly full maturity on May 12. At this stage seed shattering can be a serious problem.

prior to pod maturity, and swathed, as is done in western Canada, it is likely seed yields would have been higher. In another test at the Plant Breeding Unit, varieties yielded 1,420 to 2,360 pounds seed per acre, table 3.

Seed yields at the Tennessee Valley Substation in northern Alabama were poor the first year when late cutting resulted in much

TABLE 3. SEED YIELD OF RAPESEED VARIETIES AT PLANT BREEDING UNIT, TALLASSEE, 1980-81

	Plant height	Date of 50 percent bloom	Date of Harvested	Seed yield per acre
	Ft.			*Lb.*
Jet Neuf	4	April 15	May 28	2,360 a*
Dwarf Essex	6	April 15	May 28	2,070 ab
Rapora	3	April 15	May 28	2,050 ab
Gorczanski	4	April 15	May 21	2,040 ab
Sipal	4	April 5	May 21	1,890 ab
O RB 78-259	5	April 5	May 21	1,870 ab
Quinta	6	April 10	May 28	1,770 ab
Primor	4	April 10	May 21	1,700 b
Herkules	3	April 10	May 28	1,530 b
Norde	3	April 15	May 21	1,530 b
Brink	5	April 5	May 21	1,420 b
Bishop	8	April 25	June 4	-

*Any two yields within a column having the same letter are not significantly different at 5 percent level.

Planted: Oct. 13, 1980
Soil: Canada fine sandy loam.

TABLE 4. SEED YIELD OF RAPE VARIETIES AT TENNESSEE VALLEY SUBSTATION OVER 2 YEARS

Variety	Seed yield per acre		
	1980	1981	Average
	Lb.	*Lb.*	*Lb.*
Quinta	-	2,770 a	-
Sipal	-	2,600 ab	-
Garant	-	2,540 ab	-
Brink	1,430 a	2,430 abc	1,930
Herkules	-	2,230 abc	-
Dwarf Essex	1,000 b	1,880 bc	1,440
Gullivar	700 c	1,730 c	1,220
Planted:	Oct. 9	Oct. 7.	

*Any two yields within a column marked with the same letter are not significantly different at 5 percent level.
Soil: Decatur clay.

shattering, table 4. The second year, yields were better when plants were cut earlier as each variety matured.

Yields of the best varieties exceeded 2,000 pounds per acre at Prattville Experiment Field in central Alabama when cut early to reduce shattering losses, table 5. Yields of the top varieties at the Black Belt Substation in west central Alabama and at the Gulf Coast Substation in south Alabama exceeded 1,500 pounds per acre, table 6. Seed yields at Brewton Experiment Field were lower, probably a result of shattering. Two plantings in previous years at the Black Belt Substation failed because volunteer ryegrass *(Lolium*

TABLE 5. SEED YIELD OF RAPESEED VARIETIES AT PRATTVILLE EXPERIMENT FIELD

Variety	Date of 50 percent bloom	Date of harvested in 1981	Seed yield per acre			
			1979	1980	1981	Average
			Lb.	*Lb.*	*Lb.*	*Lb.*
Quinta	April 15	May 27	-	-	2,630 a	-
Garant	April 15	May 27	-	-	2,580 a	-
Gullivar	March 15	May 19	2,280 a*	550 c	1,800 b	1,540
Dwarf Essex ...	April 20	June 1	1,640 b	940 b	1,790 b	1,460
Herkules	April 15	June 1	-	-	1,780 b	-
Sipal	April 10	May 20	-	-	1,750 b	-
Brink	April 5	May 20	1,740 b	1,230 a	1,020 c	1,330
Solo	March 30	May 20	-	-	110 d	-
Midas	March 10	-	1,700 b	450 c	-	-
Date planted	-	-	Oct. 2	Oct. 14	Oct. 10	

*Any two yields within a column marked with the same letter are not significantly different at 5 percent level.
Soil: Lucedale fine sandy loam.

TABLE 6. SEED YIELD OF RAPESEED VARIETIES AT THREE LOCATIONS IN 1980-81

Variety	Black Belt Substation		Brewton Exp. Field		Gulf Coast Substation	
	Date harvested	Seed yield per acre	50 percent bloom date	Seed yield per acre	Date harvested	Seed yield per acre
		Lb.		*Lb.*		*Lb.*
Gullivar	May 13	1,330 bc*	March 25	1,170 a	May 13	2,090 a
Quinta	May 26	1,360 bc	April 4	740 ab	May 21	1,590 b
Garant	May 26	1,270 bc	April 4	720 abc	May 21	1,380 bc
Sipal	May 26	1,840 a	April 2	790 ab	May 21	980 cd
Brink	May 26	1,190 c	March 31	350 bcd	May 21	940
Herkules	May 28	1,460 bc	April 6	250 cd	May 21	710 d
Dwarf Essex ...	May 28	1,520 b	April 6	480 bcd	May 21	640 d
Solo	May 13	460 d	April 1	80 cd	May 5	150 e
Planted	Oct. 21		Oct. 27		Nov. 3	
Soil	Sumter clay		Benndale sandy loam		Marlboro fine sandy loam	

*Any two yields within a column marked with the same letter are not significantly different at 5 percent level.

multiflorum) choked out the rape. Ryegrass has been the only competing weed pest observed in rape trials.

Oil content of selected rape varieties appears to be fairly comparable with that reported elsewhere, table 7. Seed oil content of 40 percent is slightly lower than generally obtained in Europe.

Gullivar, a low erucic acid type, appears to be the best performing variety at all locations except in northern Alabama. It matures earlier than other high-yielding varieties such as Dwarf Essex. Other varieties showing promise are Quinta, Garant, Sipal, Jet

TABLE 7. OIL CONTENT OF RAPESEED VARIETIES AT PLANT BREEDING UNIT OVER 2 YEARS

Variety	Oil content of seed	
	1979	1980
	Pct.	*Pct.*
Gullivar	43	40
Dwarf Essex	40	39
Midas	43	-
Brink	-	40
Quinta	-	39
Garant	-	38

Neuf, Gorczanski, Rapora, ORB 78-259, Herkules, and Primor. ORB 78-259, an unreleased variety, is especially attractive for industrial use because of its high erucic acid content and low level of glucosinolate. Seed of Dwarf Essex, a commercially available variety, contains about 43 percent erucic acid in the oil.

Method of Planting

Generally, rape for seed production in humid areas is seeded in 12-to 14-inch rows. Seeding rate in our trials was 5 to 8 pounds per acre which resulted in small stem size and some lodging. A lower seeding rate of about 2 to 4 pounds per acre should increase stem diameter and reduce lodging.

Planting Date

Planting dates had a marked effect on plant growth and seed yield, figure 6. Satisfactory rapeseed yields were obtained in central and northern Alabama only when planting was done in early-to mid-October, table 8. Seed yields up to 3,300 pounds per acre were achieved in one test. At the Gulf Coast Substation where a mild winter climate prevails, late planting resulted in good seed yields. In southern Alabama, November planting appears to be desirable.

FIG. 6. Gullivar rape on March 30 at Brewton Experiment Field planted Nov. 25 (left), Nov. 10 (center), and October 27 (right).

TABLE 8. GULLIVAR RAPESEED YIELD AS AFFECTED BY PLANTING DATE AT FIVE LOCATIONS IN 1980-81

Planting date	Seed yield per acre				
	Tennessee Valley Subst.	Prattville Exp. field	Plant Breeding Unit	Brewton Exp. field	Gulf Coast Subst.
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Oct. 7	3,370 a*				
Oct. 21	2,960 a				
Nov. 3	1,310 b				
Oct. 10		2,930 a			
Oct. 24		1,780 b			
Nov. 7		1,110 b			
Oct. 3			2,140 a		
Nov. 7			1,020 b		
Oct. 27				1,330 a	
Nov. 10				990 b	
Nov. 25				860 b	
Nov. 3					2,770 a
Dec. 2					1,530 b
Dec. 18					1,450 b

*Any two values within a column marked with the same letter are not significantly different at 5 percent level.

Effect of Cutting Forage on Seed Yield

Rape can be grazed for forage but results of trials in central Alabama show this practice will sharply reduce seed yields, table 9, figure 7. Two cuts of forage resulted in no seed production. It is possible a higher rate of nitrogen might affect this but one can expect reduced seed yields from cutting or grazing.

Similar adverse results from cutting are shown in another experiment, table 10. In addition, wide row spacing increased seed yield of Gullivar rape in 1 of 2 years.

TABLE 9. EFFECT OF CUTTING ON FORAGE AND SEED PRODUCTION OF DWARF ESSEX RAPE AT PLANT BREEDING UNIT, 2-YEAR AVERAGE

Cutting treatment	Forage yield per acre	Seed yield per acre
	Lb.	*Lb.*
No cut	0 c*	2,640 a
Cut once	960 b	1,360 b
Cut twice	1,530 a	0 c

*Any two values within a column marked with the same letter are not significantly different at 5 percent level.

FIG. 7. Cutting forage generally reduces rape seed yield. Dwarf Essex rape uncut (center), cut once (right), and cut twice (extreme right), Jan. 10.

TABLE 10. EFFECT OF ROW SPACING AND CUTTING ON FORAGE AND SEED YIELD OF TWO RAPE VARIETIES AT PLANT BREEDING UNIT, TALLASSEE, 1979-80 AND 1980-81

Variety	Cutting management	Row width	Forage yield per acre			Seed yield per acre		
			1980	1981	Average	1980	1981	Average
		In.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Gullivar	None	12	0	0	0	280	2,070 a	1,180
Gullivar	None	6	0	0	0	290	1,690 b	990
Gullivar	Once	12	200 d*	560 c	380	0	830 e	830
Gullivar	Three cuts	6	690 b	1,620 b	1,160	0	0 f	0
Dwarf Essex	None	12	0	0	0	740	1,470 bc	1,110
Dwarf Essex	None	6	0	0	-	690	1,300 cd	1,000
Dwarf Essex	Once	12	340 c	810 c	580	460	1,000 de	730
Dwarf Essex	Three cuts	6	1,040 a	2,010 a	1,520	0	0 f	0

*Any two yields within a column marked with the same letter are not significantly different at 5 percent level.

Effect of Nitrogen Fertilizer

Where Gullivar rape was planted during mid-November in central Alabama, in rotation with Bragg soybeans, the yield response to nitrogen was good, figure 8. Results of this study suggest that rape will require 45 pounds of nitrogen per acre in autumn and 60 pounds of nitrogen per acre in early spring. Where rape does not follow soybeans, nitrogen requirement will probably be higher. Oil content of the seed was unaffected by nitrogen fertilization averaging 40 to 44 percent both years. European research has shown rape has a higher requirement for nitrogen than most other field crops. This indicates variety trials in Alabama may not have received enough nitrogen fertilizer for maximum seed production.

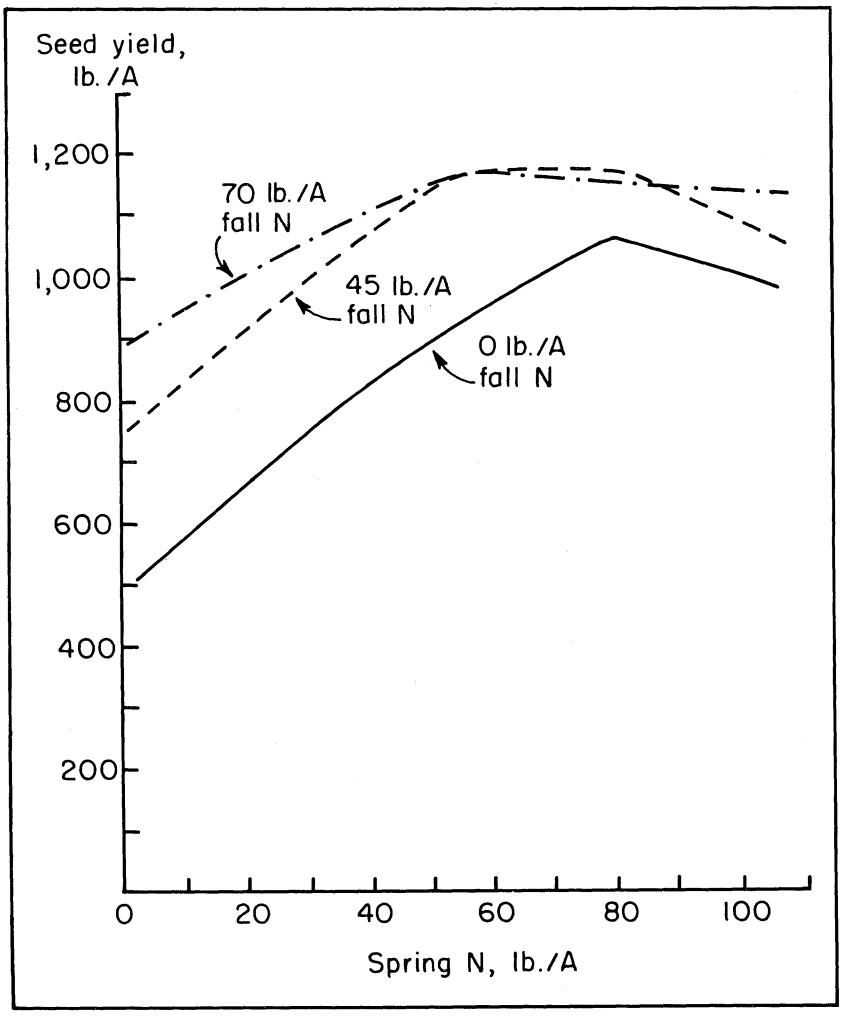

FIG. 8. Effect of nitrogen (N) on rape seed yield. The rape was grown in rotation with soybeans on the E. V. Smith Research Center in central Alabama. The yields are averages of the 1979-80 and 1980-81 growing seasons.

Effect of Lime, Phosphorus, and Potassium

Where soil pH was 5.5, application of 1.5 tons lime per acre had no effect on seed yield the first year and only a small effect the second year, table 11. Research in Europe has shown rape can tolerate considerable soil acidity.

No experiments were conducted on rape response to phosphorus and potassium. European research has shown that rape has about

TABLE 11. EFFECT OF LIME ON SEED YIELD OF GULLIVAR RAPE GROWN ON NORFOLK FINE SANDY LOAM AT E. V. SMITH RESEARCH CENTER, CENTRAL ALABAMA

Treatment	Seed yield per acre	
	1979-80	1980-81
	Lb.	*Lb.*
No Lime	1,160 a*	1,280 b
Lime†	1,150 a	1,410 a

*Yields in the same column followed by the same letter are not significantly different at the 5 percent level.

†Lime was applied to these plots at the rate of 1.5 tons per acre in the fall of 1979. The soil pH at that time was 5.5.

the same need for phosphorus and potassium as has small grains. Research in Oregon indicates rape has a high requirement for sulfur, which could be a problem on some Southeastern United States soils. On sandy soils, 10 pounds of sulfur per acre probably should be applied annually.

Effect of Boron

No response to boron was obtained the first year, but during the second year a yield response was obtained, table 12. This is not surprising since closely related crops such as cauliflower *(Brassica olceracea* var. botrytis) have a high boron requirement. Boron had no effect on oil content of the seed. On sandy soils, it would be desirable to apply 1 pound of boron per acre per year.

TABLE 12. EFFECT OF BORON ON SEED YIELD OF GULLIVAR RAPE GROWN ON NORFOLK FINE SANDY LOAM AT E. V. SMITH RESEARCH CENTER, CENTRAL ALABAMA

Boron Treatment per acre	Seed yield per acre	
	1979-80	1980-81
Lb.	*Lb.*	*Lb.*
0.0	1,300 a*	1,230 c
0.9	1,210 a	1,430 ab
1.8	1,230 a	1,250 bc
3.5	1,130 a	1,300 abc
5.3	1,000 a	1,370 abc
8.8	1,060 a	1,490 a

*Yields in the same column followed by the same letter are not significantly different at the 5 percent level.

†B treatments were applied broadcast and incorporated in the fall before the rape was planted.

Pests

Winter weeds, except for volunteer ryegrass, have not been a problem in rape. It is possible that wild mustard *(Brassica kaber)* could be a problem in rape. Thus, at the present time there should generally be no need to apply a herbicide on rape.

Aphids are the only insects observed to be a problem on rape in Alabama. Aphids attack the flower buds and can quickly destroy the crop, figure 9. Since aphids are relatively easy to control with insecticides, the main problem is to watch for aphid infestation and quickly apply insecticides before they cause damage.

No diseases have been observed on rape in Alabama. Parasitic nematodes in rape roots were much lower than in hairy vetch, table 13. These were mainly lance, with a few meadow nematodes. Soil parasitic nematode populations were high in the vicinity of rape roots, the species being mainly lance, stunt, and meadow nematodes.

FIG. 9. Aphids attacking flower buds of rape in April.

TABLE 13. NEMATODE POPULATIONS OF SOIL AND ROOTS OF RAPE VARIETIES IN GREENHOUSE, SAMPLED MARCH 10, 1980

Entry	Parasitic nematodes per gram of root	Parasitic nematodes per 50cc of soil
Dwarf Essex rape	13	66
Gullivar rape	17	53
Midas rape	18	68
Hairy vetch	40	64

SUMMARY

Trials over 3 years at six locations indicate that rape may offer potential as a winter cash crop for industrial oil in Alabama. Oil content of the seed will average 40 percent and crude protein content of the meal about 40 percent.

Variety trials indicate that yields of 2,000 pounds per acre or more of rapeseed are reasonable to expect with good management using varieties such as Gullivar and Dwarf Essex.

Rape should be planted in early October in northern and central Alabama. Planting can be delayed until November in the southern part of the State.

No cutting or grazing of rape should be done as this will reduce seed yield.

Nitrogen fertilizer requirements for rape following soybeans are 45 pounds per acre in autumn and 60 pounds of nitrogen per acre in early spring. When rape does not follow soybeans, more nitrogen will likely be required. Phosphorus, potassium, and lime requirements are similar to that for small grains. It is likely that 10 pounds of sulfur per acre and 1 pound of boron per acre should be applied annually, especially on sandy soils.

Aphids can be a serious pest on rape and insecticide treatment is essential.

Seed shattering is a serious problem on rape and ideally the crop should be cut and swathed when green before combining.

Farmers interested in growing this new crop should obtain contracts prior to planting and then plant only a small acreage until experience in handling is gained.

Alabama's Agricultural Experiment Station System
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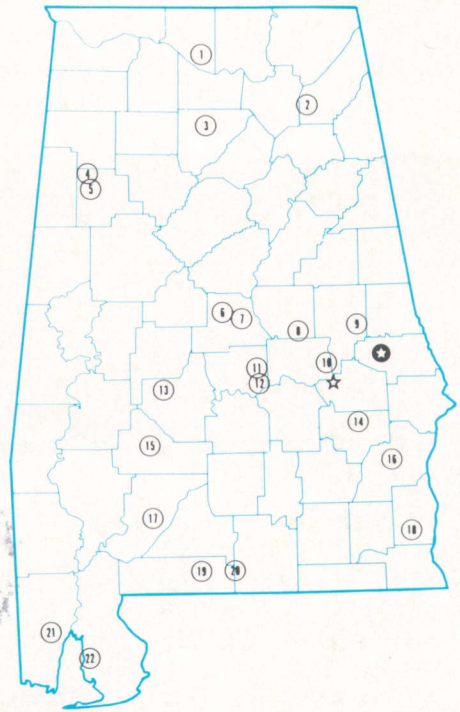

Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. The Turnipseed-Ikenberry Place, Union Springs.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Solon Dixon Forestry Education Center, Covington and Escambia counties.
21. Ornamental Horticulture Field Station, Spring Hill.
22. Gulf Coast Substation, Fairhope.