Winter rapeseed performance in the southeastern Coastal Plain

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*ABSTRACT: Fifty-five rapeseed (*Brassica napus L.*) cultivars were evaluated between 1982 and 1987 on a Norfolk loamy sand (fine, loamy, siliceous, thermic* Typic Paleudult*) near Florence, South Carolina. The average seed yield (1,590 kg/ha or 1,420 pounds/acre) was comparable to that at other southern locations where rapeseed is grown as a winter annual, but it was lower than in the Pacific Northwest, where the crop is grown as a true biennial. Assuming a contract price of $0.20/kg ($0.09/pound), estimated gross returns for rapeseed would be about $320/ha ($130/acre). For conservation purposes, the crop may be more valuable because of its potential to reduce soil erosion; rapeseed provides soil surface cover at an earlier date than winter wheat (*Triticum aestivum L.*). Results of this evaluation suggest that additional research is needed to evaluate rapeseed as a winter forage and/or cover crop for soil erosion control.*

DOUBLE cropping is becoming increasingly common in the southern United States where growing seasons are long, water resources generally are ample, local markets are expanding, and the geographic location for exporting agricultural products is favorable (*5*).

Wheat (*Triticum aestivum* L.) is currently the predominate winter crop in the South (*8*). During 1984, 1985, and 1986, producers planted wheat on an average of 1.25 million ha (3.0 million acres) in Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, North Carolina, and Virginia. Soybeans [*Glycine max* (L.) Merr.] generally are planted after wheat is harvested and often yield as much as full-season, monocropped soybeans. Crimson clover (*Triticum incarnatum* L.) is a winter cover crop that can provide N for a subsequent corn (*Zea mays* L.), grain sorghum [*Sorghum bicolor* (L.) Moench], or soybean crop (*4, 10*). Rapeseed (*Brassica napus* L.), a relatively new crop in the South (*3, 6*), has not been fully evaluated for this region.

Rapeseed is an important oilseed crop in northern Europe and Canada and has excellent potential for full-season production in the Pacific Northwest (*1*). Extracted oil can be used for either human consumption or industrial purposes, depending upon the fatty acid composition associated with specific cultivars. Among its industrial uses are diesel fuel substitution, if appropriate additives can be developed to inhibit carbon and gum formation, and machine lubrication in water or steam-pressurized environments (*2*). Agronomically, rapeseed can be planted with conservation tillage techniques (*3, 7*), grown for seed, used as forage for grazing animals, and/or used as a cover crop to control soil erosion. Previous research on the use of rapeseed in the Southeast (*6*) demonstrated the potential for seed yields to be in excess of 2.2 Mg ha^{-1} (1,960 pounds/acre), but more research is needed to determine long-term effects of winter rapeseed in southeastern agroecosystems (*3*).

Our objective was to evaluate several rapeseed cultivars, primarily for seed production but also as a possible winter cover crop and/or forage in the Coastal Plain.

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Study methods

Rapeseed cultivars being evaluated for the national variety trials in 1983, 1984, 1985, 1986, and 1987 were grown on Norfolk loamy sand (fine-loamy, siliceous, thermic, Typic Paleudults) near Florence, South Carolina. Each cultivar evaluated was planted in single rows spaced 76 cm (30 inches) apart in October 1982 or 1983 or in twin rows spaced 28-48-28 cm (11-19-11 inches) apart in October 1984, 1985, or 1986. We prepared seedbeds by disking two or three times to a depth of 15 cm to incorporate residue from the previous corn crop. At planting, all cultivars were in-row subsoiled to a depth of 45 cm (18 inches). A preplant fertilizer application provided 78-30-55-13 kg/ha (70-26-50-12 pounds/acre) N-P-K-S, respectively. Growth of annual grasses and small seeded broadleaf weeds was suppressed by applying trifluralin at a rate of 0.85 kg/ha (0.7 pound/acre). In February of each year, urea ammonium nitrate was broadcast to provide 67 kg/ha (60 pounds/acre) of N before reproductive growth began. In May or June, we harvested cultivars by hand and threshed them to determine seed yield. We determined vegetative cover during the winter using a line-transect method.

We calculated gross economic returns for rapeseed using current contract values and the 5-year average seed yield for the best (top 25%) cultivars grown. We compared this return to the gross, nongovernment-supported return for wheat and to the value of N added by crimson clover.

Results

We evaluated a total of 55 rapeseed cultivars during the 5-year study (Table 1). Overall average seed yields in the 5 years were 1,600, 1,860, 760, 1,360, and 2,380 kg/ha (1,427, 1,657, 679, 1,216, and 2,123 pounds/acre), respectively. Yields for many of the cultivars were not significantly different. But as expected with any national variety trial, some cultivars were not adapted for production in the South. The extremely low yield during 1985 was caused by poor stand establishment that occurred because of drought during the fall of 1984.

The cultivars grown included industrial types (>40% erucic acid in extracted oil), single-zero edible types (<2% erucic acid in extracted oil required by the U.S. Food and Drug Administration), and double-zero types (meeting Canola Council requirements for both <2% and <30 μmols/g of glucosinolate in the defatted seed meal).

The average seed yield for 1985-1986 (1,360 kg/ha) was similar to that produced at other locations in Georgia, Mississippi, North Carolina, and Virginia, where rapeseed is grown as a winter annual (9), but that average seed yield was much lower than in the Pacific Northwest (Washington and Idaho) where rapeseed is grown as a true biennial. One industrial cultivar with high

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erucic acid and glucosinolate (Dwarf Essex) was grown in 1983, 1984, 1986, and 1987. Seed yield for those 4 years averaged 1,850, 1,995, 859, 1,894 kg/ha (1,650, 1,780, 766, and 1,689 pounds/acre), respectively. In comparison, that cultivar yielded 2,794, 3,858, 4,863, and 8,642 kg/ha (2,492, 3,442, 4,338, and 7,710 pounds/acre) during 1978-1979, 1979-1980, 1980-1981, and 1985-1986, respectively, when grown in Idaho (*1*, *9*). Dwarf Essex has been grown for more than 30 years in the Pacific Northwest, primarily as a source of birdfeed and industrial oil. The lower seed yield, when grown in the South, demonstrates sensitivity to both agronomic practices, which are not yet well researched for optimal southern response, and climatic factors. The primary factor affecting Dwarf Essex adaptation is its long vernalization requirement (*9*). With additional research, cultivars with high-yield potential for the South may be developed. For example, in 1986 the commercial cultivar Mikado yielded 2,018 kg/ha (1,800 pounds/acre), while in 1987 a commercial semidwarf cultivar, Bien Venu, yielded 2,500 kg/ha (2,230 pounds/acre). One caution must be offered, however. Without expanded industrial or domestic uses, less than 7,000 ha (15,000 acres) of rapeseed production could saturate existing markets for industrial rapeseed oil (*9*).

Another use for rapeseed, which may be more feasible in the South, is as a winter forage. This would provide a nutritious animal feed (*7*) and surface cover that could reduce soil erosion. The Dwarf Essex cultivar was imported originally from Holland where it was grown for livestock forage. We did not measure biomass production in our study. But for the 1986 crop, measurements 12, 26, and 102 days after planting (October 22, November 5, and February 13) showed an average of 12%, 36%, and 66% surface cover, respectively. By way of comparison, wheat was not even planted until after the November 5 sampling date and had a February 13 surface cover of only 33%. This suggests that rapeseed may be an excellent cover crop for soil erosion control in the South.

We compared the economic value of rapeseed to that for wheat and crimson clover using estimates of gross returns. This was a generalized comparison because numerous factors, such as market availability, cropping sequence, labor resources, and farm diversification, ultimately will determine the value of new crops. Using an average contract value for rapeseed of $0.20/kg ($0.09/pound) and the average seed yield for the top 25% of the cultivars evaluated (1,982 kg/ha or 1,768 pound/acre), the gross return for rapeseed in the Coastal Plain would be $396/ha ($159/acre). Similarly, assuming a cash value for wheat of $0.10/kg ($2.80/bushel) and yields averaging 3,363 kg/ha (50 bushels/acre), the gross return for wheat would be $336/ha ($140/acre). Finally, assuming N fertilizer costs $0.45/kg ($0.20/pound) and that crimson clover can replace as much as 120 kg/ha of fertilizer N (*4*), the gross value of that crop would be $54/ha ($22/acre).

These gross returns do not attempt to assign a value for soil erosion control by these crops or to imply equivalent profitability. The values suggest that rapeseed could be a viable winter crop for the Southeast, but its potential as a forage crop or as a cover crop for erosion control may be more important than its value as a seed crop.

Additional studies with emphasis on cultivar selection, refinement of agronomic practices, and evaluation as a forage crop are needed. To establish rapeseed as a profitable seed crop in the Southeast, a marketing system would have to be established and greater demand would have to be cre-

Table 1. Seed yield for rapeseed cultivars grown near Florence, South Carolina, on Norfolk loamy sand, 1983-1987.

	Rapeseed Yields by Year (kg/ha)				
Cultivar	*1983*	*1984*	*1985*	*1986*	*1987*
Dwarf Essex	1,850ab*	1,995a-d		859e	1,894c-e
Jet Neuf	1,928ab		879a-c		2,833a
Indore	2,066a			1,330b-d	
Gorczanski	1,980a	1,666a-e			
Argus	1,568a-d	1,575c-e	464d		
SV31	1,713a-d				
Herkules	1,608a-d	2,020a-d			
Heruic	1,791a-c		598cd		
WW Emil	1,568a-d				
WW 696	1,862ab	2,068a-c	626b-d		
WW 889	1,778a-c				
WW 933	2,029a				
WW 936	1,330b-e	1,598b-e			
Orb 78-259	886e				
Norde	1,675a-d				
Rapora	1,212c-e				
Primor	1,494a-e				
Sipal	1,119de				
Quinta	1,121de				
Brink	1,447a-e				
WW 692		2,027a-d	535cd		
WW 935		1,980a-d			
WW 950		1,524d-e			
WW 955		2,115a-c			
WW 961		1,832a-d			
WW 964		1,264e			
WW 966		2,181a			
WW 977		2,119ab			
WW 984		1,910a-d			
Belinda			1,141a		
Korena			810a-d		
Lirama			692b-d		
BW 1-84			931ab		
BW 3-84			677b-d	1,667ab	
BW 8-84			817a-d		
STB			967ab		
Jupiter				1,354bc	
Bridger				1,253cd	2,705a
Elena				1,566bc	
Darmor				619e	
ID Fuel				1,383bc	
Cascade				974de	2,119b-d
Lirabon				1,243cd	
Santana				1,494bc	
Mikado				2,018a	
85-WRB-0042				1,963a	
LEI-I					2,534ab
LEI-II					2,779a
Glacier					2,717a
Mitre					2,595ab
Samtoma					2,550ab
Bien Venu					2,500ab
Arabella					2,375a-c
Ariana					1,818de
SEMU1068/83					1,564e
LSD (0.05)	637	542	355	366	535
CV(%)	21	17	26	20	16
Mean	1,601	1,858	761	1,363	2,383
Top 25%	1,973	2,121	1,013	1,804	2,758

*Means within a single year followed by the same letter are not significantly different at the 5% level of probability.

ated by identifying new uses for the seed, oil, and by-products. However, this requirement is not unique for rapeseed, but rather is required for all new crops that might increase cash flow and farm profits.

REFERENCES CITED

1. Auld, D. L., B. L. Bettis, and M. J. Dial. 1984. *Planting date and cultivar effect on winter rape production.* Agron. J. 76: 197-200.
2. Bettis, B. L., C. L. Peterson, D. L. Auld, D. J. Driscoll, and E. D. Peterson. 1982. *Fuel characteristics of vegetable oil from oilseed crops in the Pacific Northwest.* Agron. J. 74: 335-339.
3. Duncan, R. R., and C. S. Hoveland. 1986. *Double cropping winter rapeseed and grain sorghum.* Can J. Plant Sci. 66: 425-430.
4. Hargrove, W. L. 1986. *Winter legumes as a nitrogen source for no-till grain sorghum.* Agron. J. 78: 70-74.
5. Healy, R. G., and R. E. Sojka. 1985. *Agriculture in the South: Conservation's challenge.* J. Soil Water Cons. 40: 189-194.
6. Hoveland, C. S., J. W. Odom, R. L. Haaland, and M. W. Alison. 1981. *Rapeseed in Alabama.* Bull. 533. Ala. Agr. Exp. Sta., Auburn. 18 pp.
7. Jung, G. A., R. E. Kocher, and A. Glica. 1984. *Minimum-tillage forage turnip and rape production on hill land as influenced by sod suppression and fertilizer.* Agron. J. 76: 404-408.
8. Karlen, D. L., and D. T. Gooden. 1987. *Tillage systems for wheat production in the southeastern Coastal Plains.* Agron. J. 79: 582-587.
9. Mahler, K. A., D. L. Auld, W. T. Fike, J. E. Hairston, A. N. Hang, R. H. Hyerdahl, D. L. Karlen, G. G. McBee, P. L. Raymer, and D. E. Starner. 1987. *National winter rapeseed variety trial 1985-86.* Misc. Series No. 98. Univ. Idaho, Moscow.
10. Power, J. F., ed. 1987. *The role of legumes in conservation tillage systems.* Soil and Water Cons. Soc., Ankeny, Iowa. ☐