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## FORAGE YIELD AND SOILBORNE MOSAIC VIRUS RESISTANCE OF SEVERAL VARIETIES OF RYE, TRITICALE, AND WHEAT

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Winter annuals such as wheat, rye, and triticale often are used for winter grazing and spring ensilage in Kansas. Soilborne mosaic virus (SBMV) can be a serious problem in the eastern half of the state in any year. Ratings of wheat variety resistance to SBMV are updated each year, but data regarding the resistance of rye and triticale varieties to SBMV are scarce. This study was initiated to evaluate several varieties of rye (*Secale cereale* L.) and triticale (*X Triticosecale* Wittmack) for their forage production and resistance to SBMV in comparison to resistant and susceptible wheat varieties.

### Procedures

Field studies were initiated at the Cornbelt Experiment Field near Powhattan, KS and the Sandyland Experiment Field near St. John, KS in 1995 and 1996. Four rye varieties (Bonel, Elbon, Oklon, and Maton); three triticale varieties (Trit 762, Trical 102, and a Trit 762/Trical 102 blend); and two wheat varieties (Karl 92 and TAM 107) were used in 1995. In 1996, Oklon was omitted, TAM 107 was replaced by Custer and two triticale varieties (Pika and Presto) and an annual ryegrass variety (Marshall) were added to the study. A randomized block design with three replications was used.

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All varieties were planted at a rate of 90 lb seed/a on Oct. 11, 1995 and Oct. 11, 1996 at Powhattan and Oct. 9, 1995 and Oct. 3, 1996 at St. John. At Powhattan, nitrogen fertilizer was applied at a rate of 75 lb/a in the fall prior to planting each year. At St. John, nitrogen and phosphorous fertilizers were applied at 50 and 45 lb/a, respectively, in the fall prior to planting.

Visual ratings for stand survival and SBMV resistance were recorded at Powhattan on Apr. 9, 1996 and Apr. 15, 1997 and at St. John on Apr. 17, 1996 and Mar. 20, 1997. Previous observance of SBMV coupled with irrigation capabilities ensured that SBMV infection would take place at St. John. The reliance on rainfall at Powhattan reduced the probability that infection would occur there in any year. Forage harvest consisted of removing and weighing all of the aboveground biomass from a sample area in each plot. At Powhattan, forage was harvested from a 0.76 m<sup>2</sup> area on May 13, 1996 and May 22, 1997. At St. John, forage was harvested from a 5.81 m<sup>2</sup> area on May 15, 1996 and May 16, 1997.

Because all varieties were harvested on the same date, differences in maturity resulted in differences in growth stages at harvest (data not shown). The rye varieties were at early grain fill (Feekes 10.54), the wheat varieties were at anthesis (Feekes 10.51), and the triticale varieties were at boot stage or early inflorescence emergence (Feekes 10-10.1). We expected these differences in growth stage to influence relative forage production.

## Results and Discussion

**Stand Survival.** In 1996, varietal effects on stand survival ratings assessed in mid-April were different at each location (Tables 1 and 2). The average survival rating at Powhattan was 13%, whereas it was 82% at St. John. Several warm periods followed by cold periods in late February and March resulted in overall stand reductions at Powhattan, Maton, Oklon, and Karl 92 had similar survival ratings (Table 1). Bonel, Tam 107, and Elbon also had similar survival ratings that were lower than the ratings for Maton. At St. John, stand survival ratings for Oklon and TAM 107 were lower than those for all other varieties except Bonel (Table 2).

A mild winter in 1997 resulted in stand survival ratings that were similar at both locations. The average ratings were 86% at Powhattan (Table 3) and 75% at St. John (Table 4). At Powhattan, the three rye varieties, Karl 92, and Pika had similar survival ratings (Table 3). Stand survival ratings for the other triticales and Custer were similar. Marshall ryegrass winter-killed and was not harvested. At St. John,

survival ratings were similar for the rye varieties (Table 4). The triticale varieties, with the exception of Trit 762, and Karl 92 had lower survival ratings than the rye varieties, and Custer and Marshall had the lowest stand survival ratings.

**Dry Matter Production.** Dry matter production varied between locations in 1996, with averages of 1767 lb/a at Powhattan (Table 1) and 5342 lb/a at St. John (Table 2). Variations in varietal winter hardi-

**Table 1. Stand rating and dry matter production for rye, triticale, and wheat varieties grown near Powhattan, KS in 1995-96.**

Variety	Species	Stand Survival Rating†	Dry Matter (lb/a)
Bonel	Rye	12 bcd‡	1172 de
Elbon	Rye	11 bcd	1574 cd
Maton	Rye	27 a	2220 ab
Oklon	Rye	22 ab	1995 abc
Trit 762	Triticale	7 cd	2311 a
Trical 102	Triticale	4 d	640 e
Trit 762/ Trical 102	Triticale	4 cd	1647 bcd
Karl 92	Wheat	17 abc	2298 a
TAM 107	Wheat	11 bcd	2028 abc

†100 = complete stand, 0 = total stand loss

‡Values in a column followed by the same letter are not significantly different.

**Table 2. Stand rating, dry matter production, and soilborne mosaic virus (SBMV) ratings for rye, triticale, and wheat varieties grown near St. John, KS in 1995-96.**

Variety	Species	Stand Survival Rating†	Dry Matter (lb/a)	SBMV Resistance Rating‡
Bonel	Rye	73 ab§	6193 bc	3 bc
Elbon	Rye	85 a	6268 ab	3 bc
Maton	Rye	98 a	7533 a	3 bc
Oklon	Rye	55 b	6388 ab	3 bc
Trit 762	Triticale	88 a	4473 d	4 b
Trical 102	Triticale	88 a	4785 cd	4 b
Trit 762/ Trical 102	Triticale	92 a	4586 d	4 b
Karl 92	Wheat	95 a	4909 d	2 d
TAM 107	Wheat	58 b	2769 e	7 a

†100 = complete stand, 0 = total stand loss

‡1 = resistant, 9 = susceptible

§Values in a column followed by the same letter are not significantly different.

ness resulted in lower overall forage production at Powhattan compared to St. John. At Powhattan, Maton, Oklon, Trit 762, and both wheat varieties had similar forage yields (Table 1). Bonel, Elbon, and Trit 762/Trical 102 had similar forage yields that were lower than those of Trit 762 and Karl 92. Trical 102 had lower forage yields than all other entries, with the exception of Bonel. At St. John, TAM 107 had the lowest forage yield (Table 2). Elbon, Maton,

**Table 3. Stand rating and dry matter production for rye, triticale, wheat, and ryegrass varieties grown near Powhattan, KS in 1996-97.**

Variety	Species	Stand Survival Rating†	Dry Matter (lb/a)
Bonel	Rye	93 ab‡	7825 ab
Elbon	Rye	90 abc	7772 ab
Maton	Rye	100 a	8312 a
Pika	Triticale	97 ab	6226 bc
Presto	Triticale	77 cd	5226 cd
Trit 762	Triticale	72 d	4328 d
Trical 102	Triticale	85 bcd	5492 cd
Trit 762/ Trical 102	Triticale	85 bcd	5652 cd
Karl 92	Wheat	90 abc	5529 cd
Custer	Wheat	72 d	4750 cd
Marshall	Ryegrass	Winterkill	—

†100 = complete stand, 0 = total stand loss

‡Values in a column followed by the same letter are not significantly different.

**Table 4. Stand rating, dry matter production, and soilborne mosaic virus (SBMV) ratings for rye, triticale, wheat, and ryegrass varieties grown near St. John, KS in 1996-97.**

Variety	Species	Stand Survival Rating†	Dry Matter (lb/a)	SBMV Resistance Rating‡
Bonel	Rye	95 ab§	7913 abc	2 c
Elbon	Rye	95 ab	9160 a	2 c
Maton	Rye	97 a	8116 ab	2 c
Pika	Triticale	72 c	6360 cd	2 c
Presto	Triticale	78 c	7170 bcd	3 c
Trit 762	Triticale	80 bc	6856 bcd	5 b
Trical 102	Triticale	72 c	6952 bcd	5 b
Trit 762/ Trical 102	Triticale	70 c	6168 d	5 b
Karl 92	Wheat	72 c	7181 bcd	1 d
Custer	Wheat	47 d	3511 e	9 a
Marshall	Ryegrass	37 d	3996 e	1 d

†100 = complete stand, 0 = total stand loss

‡1 = resistant, 9 = susceptible

§Values in a column followed by the same letter are not significantly different.

and Oklon had similar forage yields. The triticale varieties and Karl 92 produced less forage than all of the rye varieties except Bonel.

In 1997, dry matter productions at the two locations differed by less than 10%, averaging 6160 lb/a at Powhattan (Table 3) and 6669 lb/a at St. John (Table 4). At Powhattan, the rye varieties had similar forage yields (Table 3). Pika, a triticale, had forage yields similar to those of Bonel and Elbon. Pika, Presto, Trical 102, Trit 762/Trical 102, and the wheat varieties all had similar forage yields. Forage yields of Trit 762 were similar to yields of all these varieties except Pika. At St. John, the rye varieties had similar forage yields (Table 4). Maton, Bonel, Karl 92, and all the triticales except the blend had similar forage yields. Custer and Marshall had lower forage yields than all other varieties.

**Soilborne Mosaic Virus Ratings.** Ratings for SBMV indicated that resistance is present in the triticale and rye varieties included in this study. As expected, Karl 92, a resistant wheat variety, received low SBMV scores (2 in 1996 and 1 in 1997) (Tables 2 and 4, respectively). TAM 107, the susceptible check in 1996, received an SBMV score of 7, and Custer, the susceptible check in 1997, received an SBMV score of 9. In 1996, the SBMV scores of the rye and triticale varieties ranged from 2 (resistant) to 4 (moderately resistant). The triticales received scores indicating moderate resistance to the virus, whereas three of the four rye varieties received scores of 3 and Bonel received a score of 2. In 1997, the SBMV ratings were more variable in the rye and triticale varieties. The rye varieties and Pika all received scores of 2, whereas Presto received a 3, and the remaining three triticales received scores of 5. Marshall ryegrass received an SBMV rating of 1.

## Conclusions

The rye varieties grown in this study were more winter hardy than the triticale varieties. On average, the rye varieties produced higher forage yields than the other two species groups at St. John in both years and at Powhattan in 1997. However, the later maturing triticales might be able to produce forage yields similar to those of the rye varieties if harvested later in the growing season. The triticale varieties demonstrated tremendous spring growth potential, because they yielded well despite stand losses from cold temperatures in the winter and spring of 1996. All varieties of rye and triticale received SBMV ratings ranging from moderately resistant to resistant. Marshall ryegrass showed excellent resistance to SBMV but had difficulties surviving the winter in Northeast Kansas and did not yield well in South Central Kansas. These results indicate that producers in Kansas can plant the rye and triticale varieties assessed in this study for forage or ensilage in fields infected with soilborne mosaic virus without significant yield losses.

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