INTERCROPPING WIDE GRASS ROWS TO IMPROVE EARLY STAND YIELDS

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One of the agronomic strategies advocated for improving the yield of forage crops in semiarid conditions is to grow them in widely spaced rows. Studies at Swift Current have shown that rows spaced 90 cm apart produce the highest yields over the long term. Unfortunately, a stand seeded in rows 90 cm apart takes 3 to 5 years to attain its full yield potential. Many producers find these years of reduced yield a problem because it endangers their income over the short-term.

The study described herein was set up to investigate the short term and the long term consequences of seeding an annual crop, or a short-lived perennial crop, or both, between the rows of the permanent crop in order to provide short term production while the permanent crop is developing its full yield potential.

MATERIAL AND METHODS

In the spring of 1980, plots of Russian wild ryegrass (RWR), Altai wild ryegrass (AWR) were seeded in rows 90 cm apart. Plots of RWR or AWR in alternate rows with alfalfa were also seeded at a spacing of 90 cm. Each plot consisted of 4 rows. At the same time, in the space between the rows, one of six intercropping treatments was seeded. The intercrops cosisted of (a) 1 row of oats; (b) 2 rows of oats; (c) 1 row of slender wheatgrass (SWG); (d) 2 rows of SWG; (e) 1 row of oats and 1 row of SWG; (f) no intercrop (control). Oats was chosen as an intercrop because oats is the most commonly used companion or 'nurse' crop used in this area. Slender wheatgrass was used as a short lived perennial intercrop because tests in this area have shown SWG to have a 3 to 5 year life under a haying regime. The oats were seeded at a rate equivalent to 17% (1 row) and 33% (2 rows) of the normal seeding rate for oats. All forage species were seeded at a rate equivalent to 100 seeds /metre row. The 24 treatments were replicated 4 times and laid out in a randomised complete block design.

The oats were harvested early in the establishment year (1980) as hay to reduce the effect upon the forage seedlings of competition for water. Only the oats growing in-between the centre two rows of the permanent forage crops were sampled for yield. The forages were not cut. This is a recommended agronomic practice in south-western Saskatchewan.

In 1981 and in each subsequent year, the centre two rows of the main crops (RWR, AWR, alfalfa) were cut separately for yield estimates. The intercrop (1 or 2 rows of SWG) was also sampled separately from between these two centre rows.

Two cuts were taken to estimate yield in each year 1981

through 1983, one in early June and the second when there was sufficient regrowth. From then on a series of dry summers resulted in only one cut being taken each year since drought resulted in insufficient regrowth. Data was statistically analysed using ANOVA techniques.

RESULTS AND DISCUSSION

Oat yields obtained during the forage establishment year show clearly the effects of interspecific competition (Table 1.). Two rows of oats yields more than one row of oats but when the one row of oats is seeded with SWG, oat yields are reduced. The comparative effects of the two grasses are not so clear but the data suggests that seedling RWR is less competitive than the seedling AWR, despite the well known highly competitive ability of RWR once it is established. Much more competitive than the grass seedlings are the alfalfa seedlings. Oat yields were significantly reduced when alfalfa was grown in alternate rows with one of the grasses.

Significant positive correlations are known to occur, for the Swift Current area, between forage yields and the precipitation during March, April, May, and the previous September. Second cuts, taken near the end of July, depend largely upon rainfall in June and July.

TABLE 1. Dry matter yield of oats seeded as a forage companion crop.

Forage Crop	Oat Intercrop			
	1 Row	2 Rows	Oat/SWG	Mean
	(kg/ha)			
RWR/alfalfa	1396	1876	1055	1442
AWR/alfalfa	1368	1850	1415	1544
RWR	1725	2009	1645	1793
AWR	1350	2315	1110	1592
Mean	1460	2013	1307	1593

Although the establishment year (1980) was a little below the long-term mean for the period after seeding, all the seeded crops established well. The following three years received above average rainfall. The fourth and fifth harvest years (1984 and 1985) and the seventh and eighth harvest years (1987 and 1988) were drought years with lower than average precipitation in all growing season months. A very wet May in 1986 resulted in good first cut yields for that year but it too was followed by a dry summer.

The fluctuations from year to year in precipitation, as well as the stage of establishment, are reflected in the yields of the forage crops without the presence of an intercrop (Figs. 1a, 2a, 3a, 4a). Separation of the two effects is therefore difficult; however, the data indicates that the stands were below their maximum yield potential in 1981, and probably in 1982 also. By 1983, environmental effects were so great, no judgement can be made but other studies indicate that the stands would still be developing their maximum yield.

In order to avoid the confusion that would be caused by imposing the treatment yield curves on top of the actual yield curves, treatment yields are shown as percentages of the non-intercropped control yields.

Using oats as a 'nurse' crop resulted in depressed forage yields in the first harvest year (1981) in all (figs 1b, 2b, 3b) except the AWR/alfalfa combination (Fig 4b). The initial depression was followed by yield rebound (again except for AWR/alfalfa). In subsequent years, yields of both the AWR alone (Fig. 2b) and the AWR/alfalfa (Fig. 4b) were depressed and remained depressed for the rest of the study period. Russian wild ryegrass, both alone and in combination (Fig 1b, 2b), was less affected, maintaining the rebound yield increases for several years followed by small yield depressions. The data also indicates that both grasses were less affected in later years by two rows of oats than by one row (Figs 1b, 2b) whereas in combination with alfalfa (Figs 3b, 4b), two rows of oats caused the greater depression in yield.

Seeding SWG between the rows of the permanent crops resulted in very large percentage yield increases in the first few years, especially with the two grasses grown alone (Figs 1c, 2c). However, for the first year these grasses produced very little and so the additional SWG yield was very significant. In subsequent years the yield benefit due to the SWG became less as the stands developed and the SWG began to die out. In the RWR and the RWR/alfalfa stands the SWG had disappeared by 1986. It persisted in the AWR and the AWR/alfalfa plots and was still present by the last year reported here. The increased yields in 1986 in the AWR/alfalfa plots was significantly contributed to by SWG.

Apart from the AWR, after the first few years SWG in the plot resulted in the yield declining below that of the control and by this point the number of rows of SWG was largely irrelevant. The damage to the permanent forages is revealed once the yield contribution of the SWG is removed from the total yields (Figs 1d, 2d, 3d, 4d). In every case the yield has

been depressed over the course of the study although by 1988 yield recoveries were being made.

To reduce the lack of productivity by the forage stand over the short-term, producers often adopt practises that may have long-term deleterious consequences. These include using companion or 'nurse' crops such as oats at half the usual seeding rate to provide a hay or grain crop during the establishment year.

Such practises are discouraged. These results confirm that all companion crops can cause long term yield losses. Seeding oats at a very low rate will reduce the losses.

Seeding a short-lived perennial such as SWG between the rows will increase total yield in the first few years, allowing the more permanent forages to fully establish, thus 'evening-out' the yield curve over the initial short term. However, this practise will also reduce the long-term productivity of the stand. These results suggest that SWG is not the ideal crop for the purpose and that the intercrop and the main crop have to be carefully matched.

A combination of an annual (oats) and a short-lived perennial (SWG) may be the best approach to getting the best long-term yields combined with the best short-term yields.

Fig 1a. YIELD OF CONTROL CROP (RWR) WITHOUT INTERCROPPING

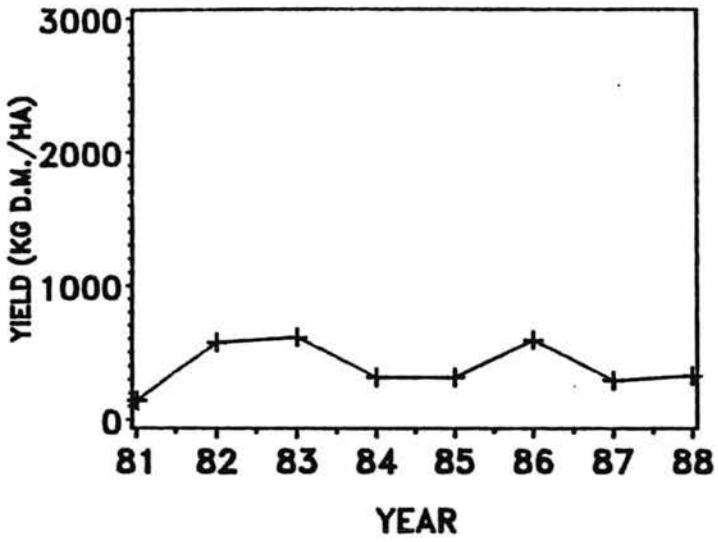

Fig 1b. EFFECT OF OATS ON S QUENT YIELDS OF RWR AS PERCENT OF C ROL YIELD

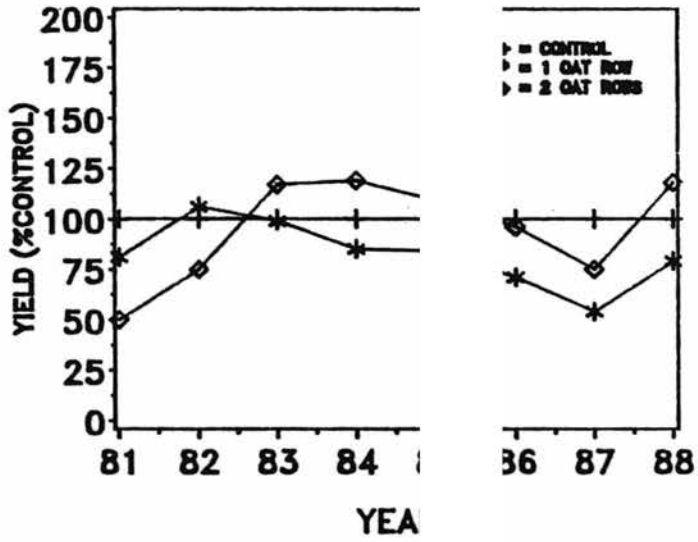

Fig 1c. TOTAL YIELD OF RWR PLOTS (INC SWG) AS PERCENT OF CONTROL YIELD

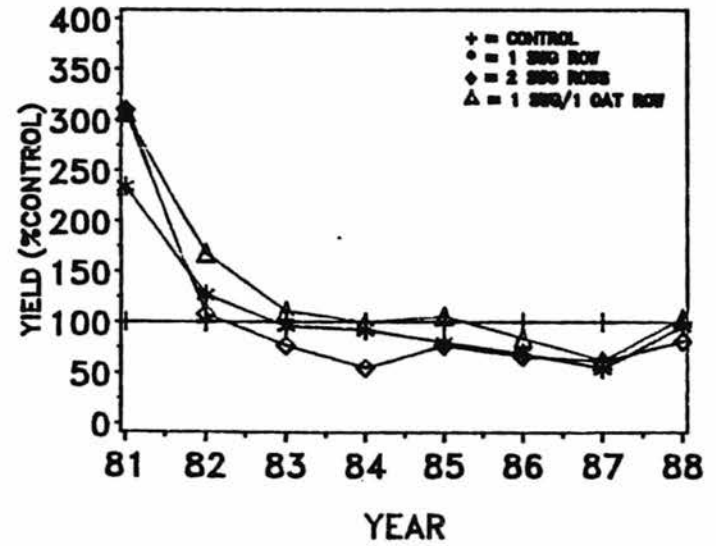

Fig 1d. TOTAL YIELD OF RWI TS (EXCLUDING SWG) AS PERCENT OF TROL YIELD

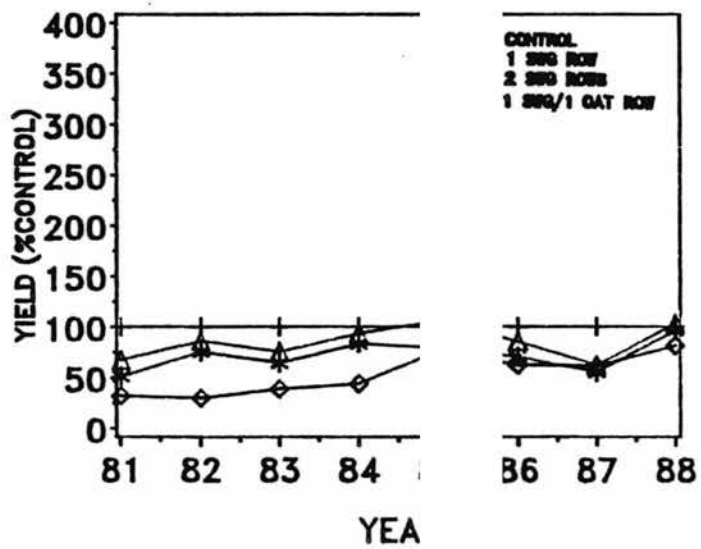

Fig 2a. YIELD OF CONTROL CROP (AWR) WITHOUT INTERCROPPING

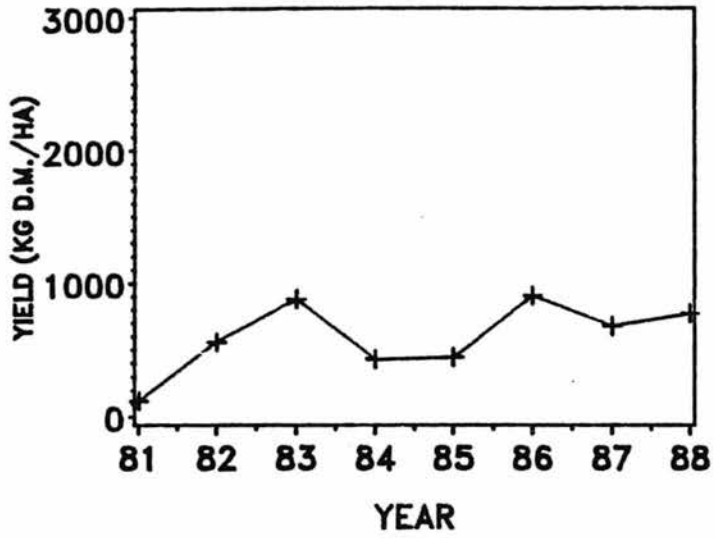

Fig 2b. EFFECT OF OATS ON SUBSEQUENT YIELDS OF AWR AS PERCENT OF CONTROL YIELD

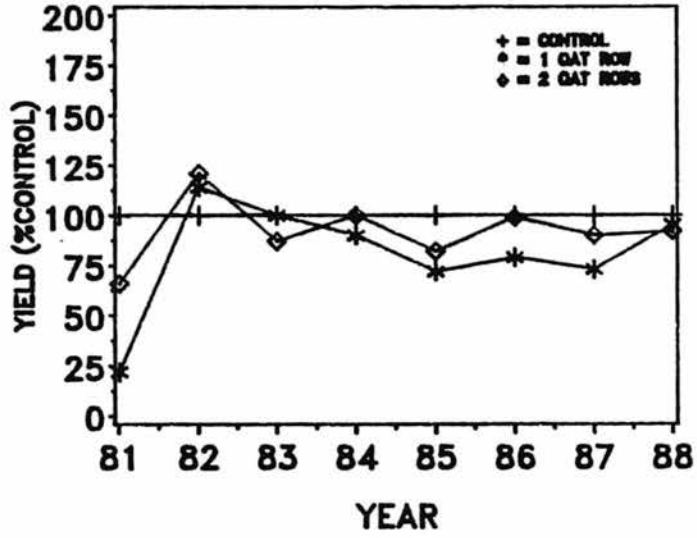

Fig 2c. TOTAL YIELD OF AWR PLOTS (INC SWG) AS PERCENT OF CONTROL YIELD

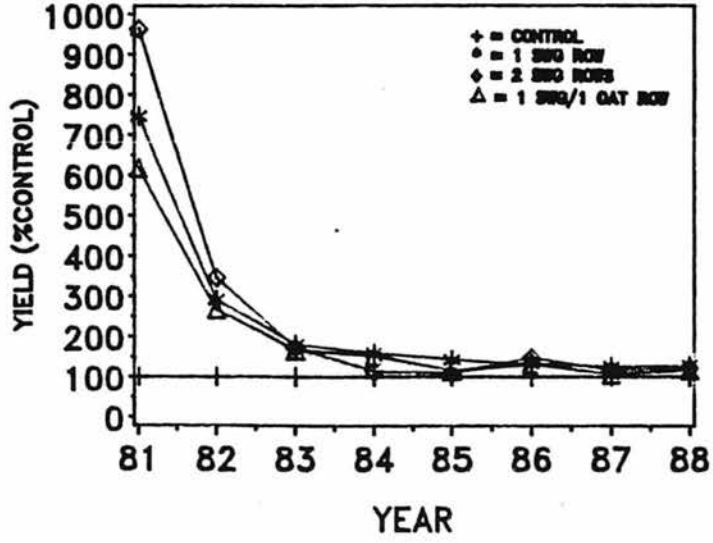

Fig 2d. TOTAL YIELD OF AWR PLOTS (EXCLUDING SWG) AS PERCENT OF CONTROL YIELD

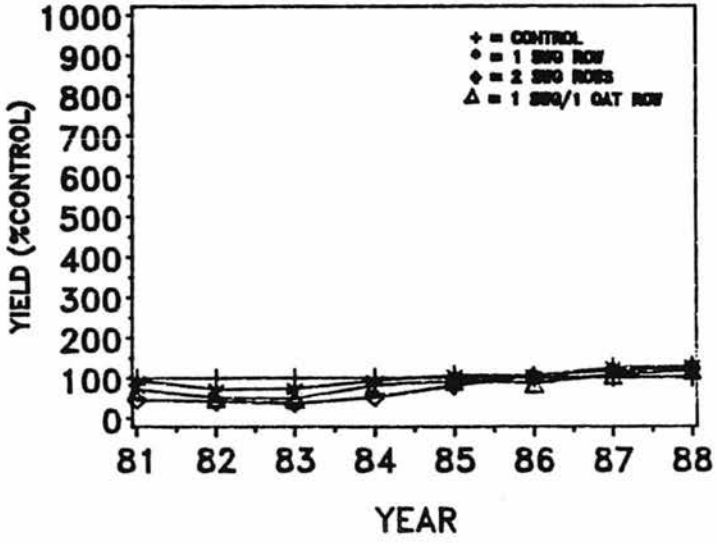

Fig 3a. YIELD OF CONTROL CROP (RWR/ALFALFA) WITHOUT INTERCROPPING

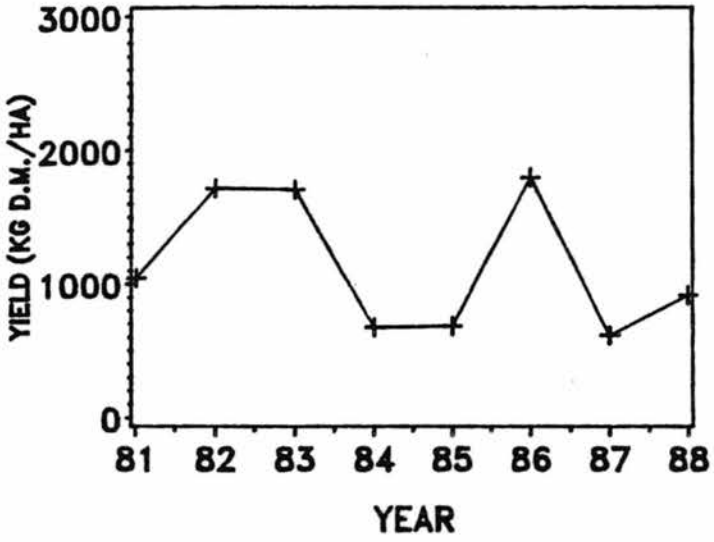

Fig 3b. EFFECT OF OATS ON SU QUENT YIELDS OF RWR/ALFALFA AS PERCENT CONTROL YIELD

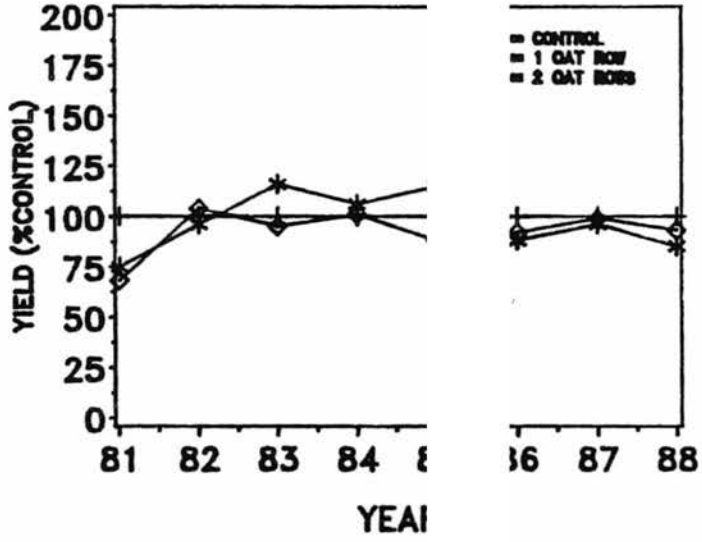

Fig 3c. TOTAL YIELD OF RWR/ALFALFA (INC SWG) AS PERCENT OF CONTROL YIELD

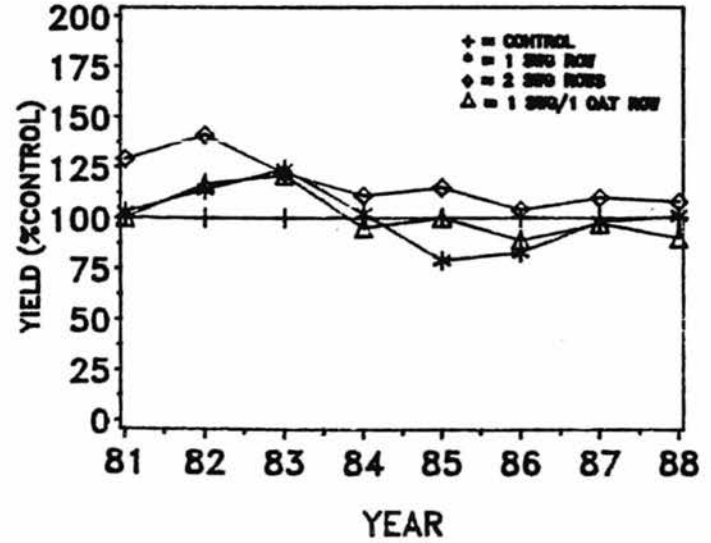

Fig 3d. TOTAL YIELD OF RWR/ LFA (EXCLUDING SWG) AS PERCENT OF ROL YIELD

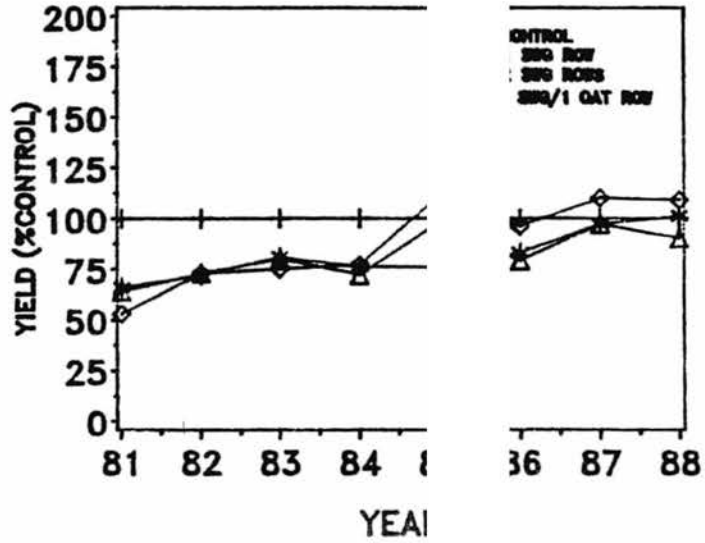

Fig 4a. YIELD OF CONTROL CROP (AWR/ALFALFA) WITHOUT INTERCROPPING

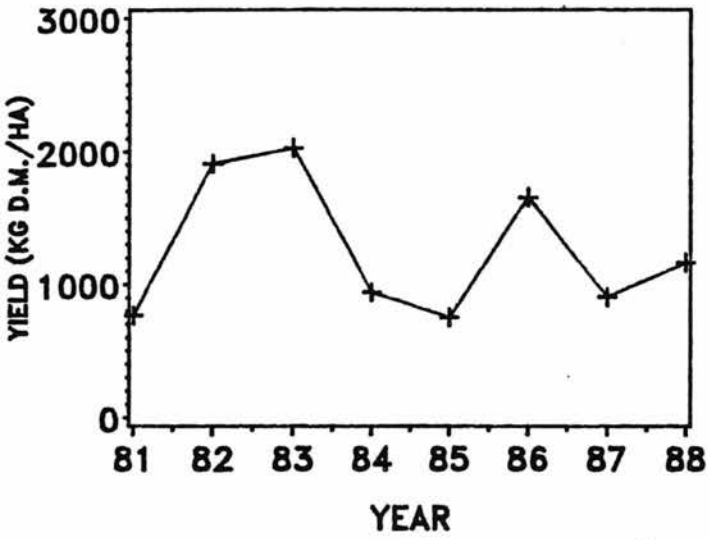

Fig 4b. EFFECT OF OATS ON SUBSEQUENT YIELDS OF AWR/ALFALFA AS PERCENT OF CONTROL YIELD

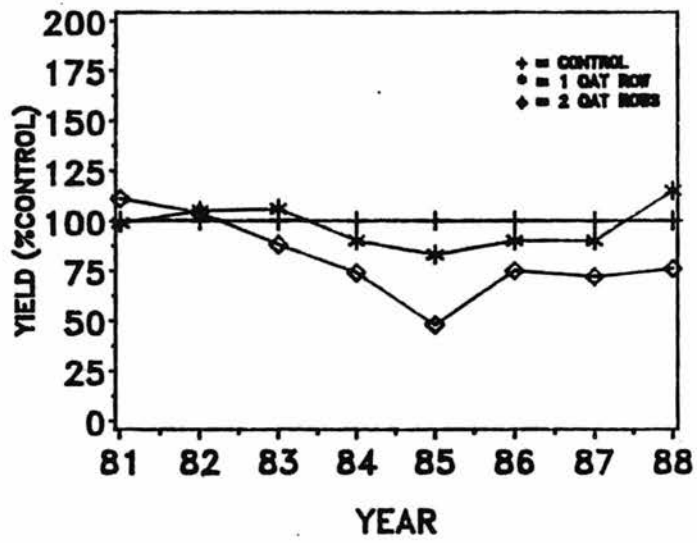

Fig 4c. TOTAL YIELD OF AWR/ALFALFA (INC SWG) AS PERCENT OF CONTROL YIELD

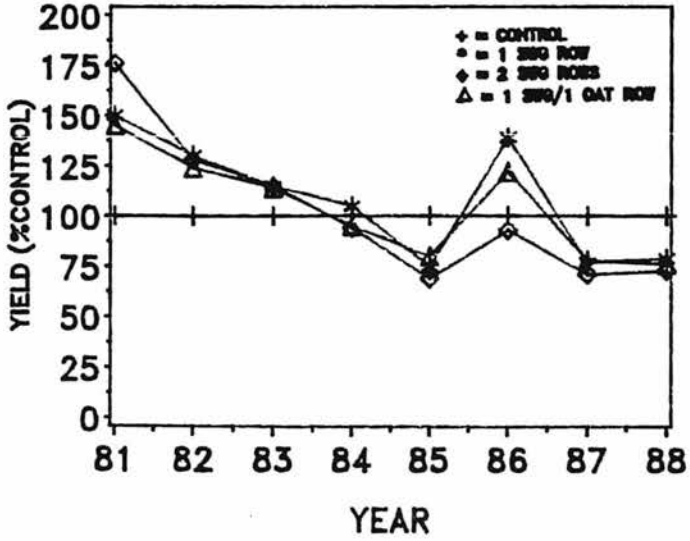

Fig 4d. TOTAL YIELD OF AWR/ALFALFA (EXCLUDING SWG) AS PERCENT OF CONTROL YIELD