THE EFFECT OF N, P, S, PRECIPITATION AND TEMPERATURE ON THE YIELD OF PASTURE ON A GRAY WOODED SOIL

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This study was conducted over a 12 year period to determine the effect N, P and S (elemental) fertilizers on yield of bromegrass (Bromus inermis L.) and alfalfa (Medicago media Pers.) pasture established on a Gray Wooded, Luvisolic soil (Waitville loam) in northeastern Saskatchewan. N fertilizer was applied at 0, 45, and 90 kg N ha^{-1} combined with 0 and 20 kg P ha^{-1}. Two additional treatments combined 90 N + 20 P (kg ha^{-1}) with 23 S and 45 S (kg ha^{-1}). In the first three years of the study, only the application of N increased yields, from 2.54 to 3.45 t ha^{-1}. Percentage alfalfa in the sward was reduced from 30.9 to 5.2% over this three years with N applied at 90 kg ha^{-1}. Over the 12 year period, N increased average herbage yield from 1.99 to 2.95 t ha^{-1}; P, from 2.23 to 3.05 t ha^{-1} and S from 3.48 to 4.19 t ha^{-1}, respectively. The response to N, P and S were curvilinear (Fig.1). The interaction effects of N x Yr, P x Yr and S x Yr all were significant indicating a wide range of response to the fertilizer elements among years. The wide range in pasture response to selected fertilizer treatments over years is shown in Fig. 2. Herbage was positively related to the total precipitation and negatively to the mean maximum temperature for the months of May, June and July (Fig.3). The highest yield (7.49 t ha^{-1}) was obtained with fertilizer at 90N-20P-23S (kg ha^{-1}), 220 mm of rainfall (May, June and July) with an average maximum temperature of 19.7 ^{o}C. The lowest yield (0.84 t ha^{-1}) was obtained with a control (no fertilizer), 160 mm of rainfall and average maximum temperature of 25.2 ^{o}C. A rise in average temperature without a corresponding increase in precipitation, would produce a significant drop in pasture herbage yield. If the greenhouse effect were to occur with an average rise in temperature of 3 ^{o}C, then pasture production could be reduced to less than 50% of what can be expected on average at the present time. Introduction of warmer season grasses for pasture might be necessary.

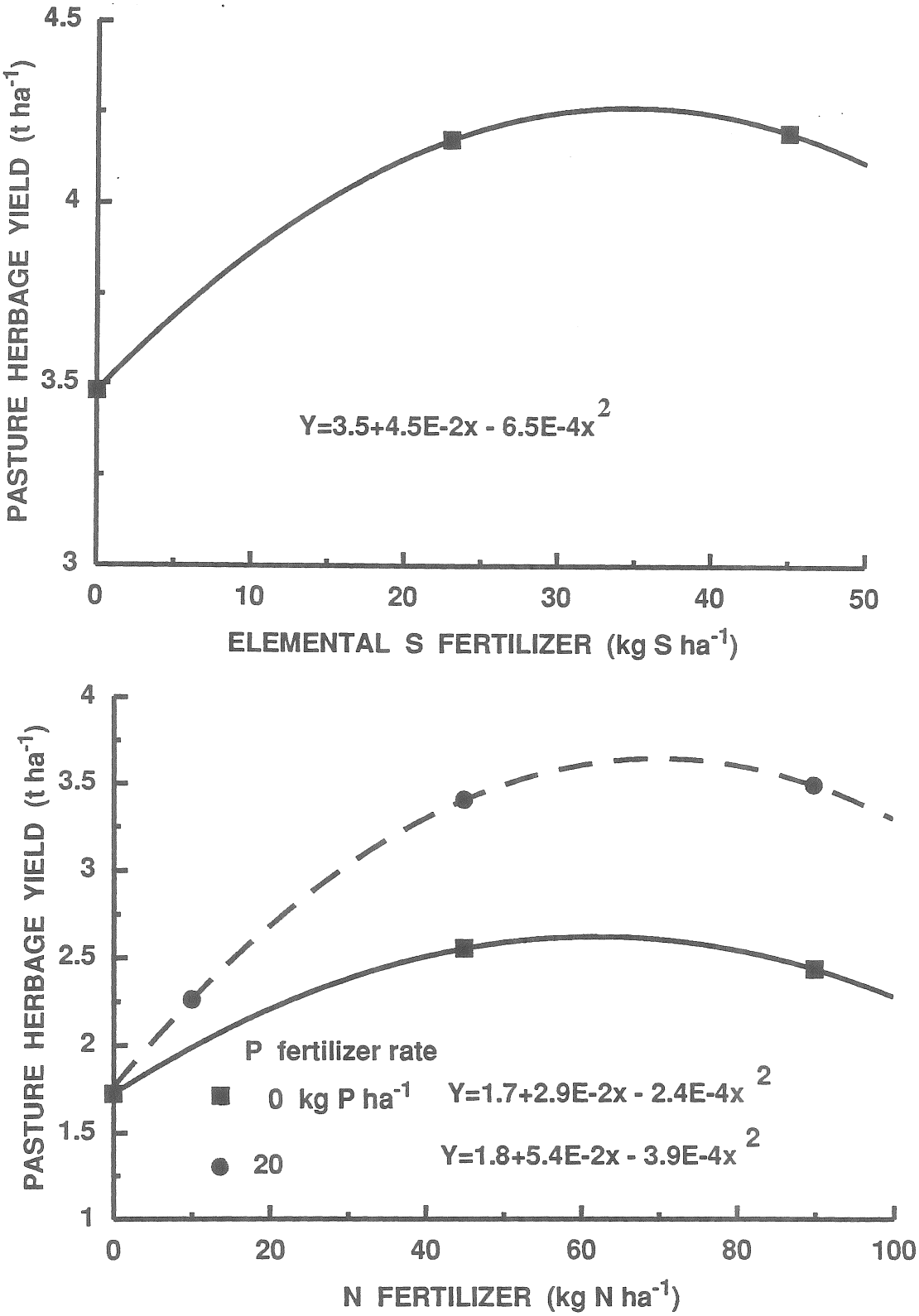

Fig. 1. The effect of N, P and elemental S fertilizer on the yield of pasture

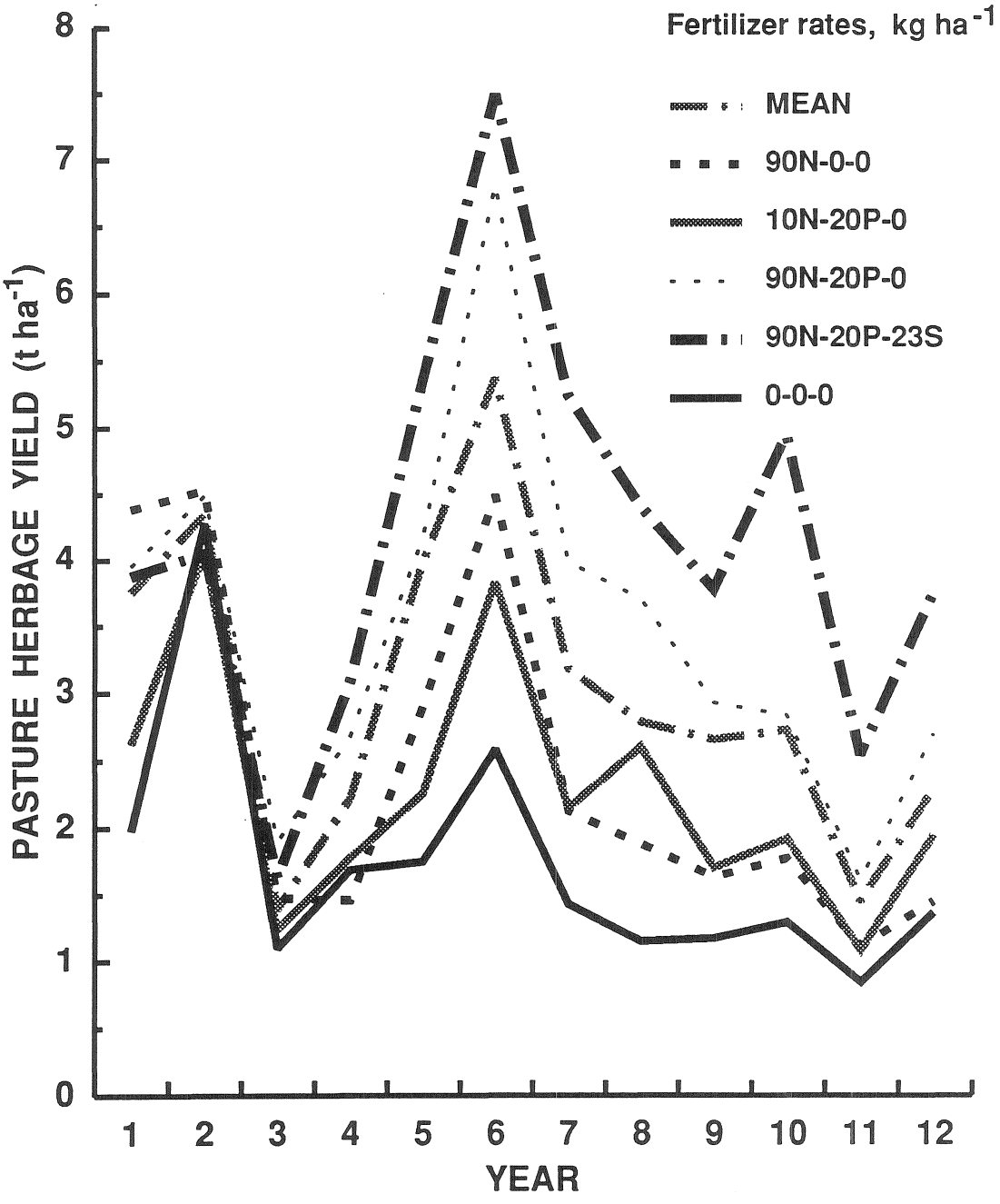

Fig. 2. Pasture yields over the years 1978 to 1989 for selected treatments.

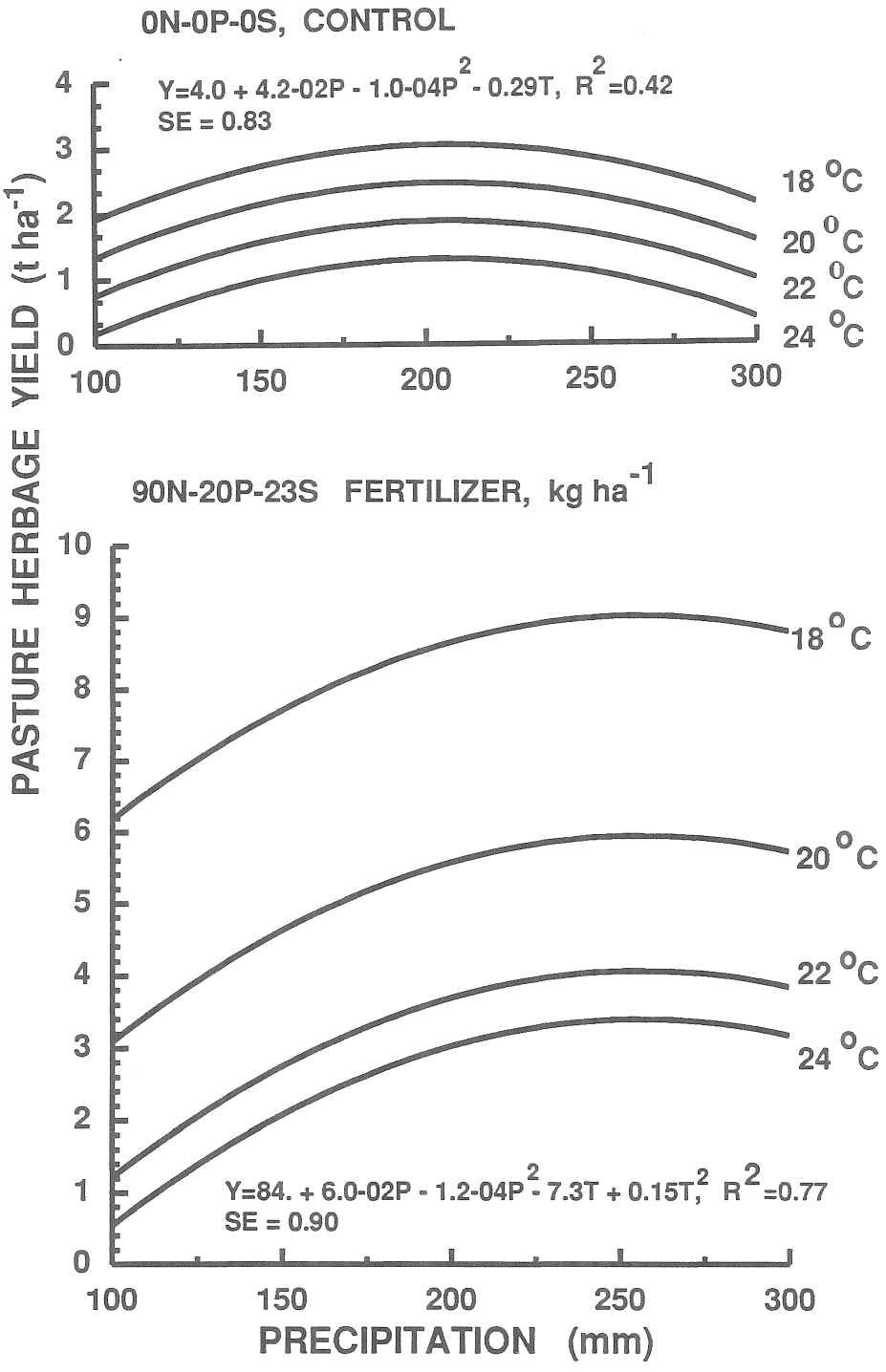

Fig. 3. The effect of May, June, July precipition and mean of May, June July maximum temperature on yield of pasture herbage.