PART II CULTURAL PRACTICES IN SASKATCHEWAN IN 1990 AND 2000 AND EFFECTS ON PRODUCTIVITY

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1.0 INTRODUCTION

There are definite indications that Saskatchewan, the "Sleeping Giant" of Western Canadian agriculture, is coming out of its slumber. The indicators of "the awakening" are complex and, sometimes contradictory. This paper presents some highlights of a comprehensive research project[3] aimed at defining future cultural practices, their impact on the soil resource, productivity and drought mitigation. The findings regarding fertilizer use and practices projected for the 1980's and 1990's are pertinent to policy decisions for Saskatchewan agriculture.

The study predicts that the historic absence of fertilizer technology in Saskatchewan farming systems will be replaced by a presence which will dominate other technology till the year 2000 A.D. It also placed a new perspective on the relative contributions of agricultural inputs towards future productivity increases.

Closing the "fertilizer gap," in Saskatchewan will enable the long-awaited transition to intensive crop production in most of the province. This phenomena will constitute the removal of the last agronomic factor limiting crop production in the humid region and part of the semi-arid protion of the province.

The full acceptance of fertilizer technology by the majority of Saskatchewan farmers by the year 2000 will be the driving force enabling the adoption of longer rotations. Optimum fertilizer use coupled with minimum tillage and water enhancement technology will raise productivity to a new plateau. These interacting technologies will also, finally, allow the utilization of latent genetic capabilities

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[3]Study Element #8 of the Saskatchewan Drought Proofing Studies. Funded by P.F.R.A. under the Canada-Saskatchewan interim subsidiary agreement on water development for regional economic expansion and drought proofing. Prime consultants: J. W. Hamm, darWall Consultants; D. R. Cameron, Normac AES; W. W. Gamble, FarmWest Management. Resource persons: D. A. Rennie, W. E. Johnson, G. Storey, J. L. Henry.

in our crop varieties.

2.0 FERTILIZER USE TRENDS AND PROJECTIONS

The magnitude of the "fertilizer gap" in Saskatchewan is best illustrated by comparing historic fertilizer and herbicide use data (Figure 2.0). The socio-economic reasons for the lag in acceptance of fertilizer technology relative to herbicides are complex. However, the dominant factor has been "perceived benefit." The effect of herbicide applications on weeds are immediately apparent to a producer whereas fertilizer effects are often less obvious, particularly at the rates recommended by the early advisory services in this province.

The current and projected fertilizer use patterns within Saskatchewan are best examined in terms of nutrient rates and areas fertilized. The rates used in 1981 relative to optimum rates prescribed by the Saskatchewan Soil Testing Laboratory are given in Table 2.1. Past, present and projected areas fertilized for the major soil zones are given in Figure 2.1.

Future rates of fertilizer application mainly will be dictated by price-cost considerations.[1] The effect of some projected grain prices and fertilizer nutrient costs[1] on rates of application can be assessed by examining the ratio of these items:

Ratio ($/mt)	1980	1990	2000
Wheat N(46-0-0)	0.95	0.64	0.70
Wheat P(11-48-0)	0.53	0.41	0.47

These data would suggest that optimum N and P rates of application will decline in the period 1980 to 1990 and increase slightly in the period 1990 and 2000. Optimum N rates will show the sharpest decline and will not return to 1980 levels. Optimum P rates will only decline slightly and will return to 1980 levels by the end of the study period.

Another factor to consider is the adequacy of N and P rates recommended by the Saskatchewan Soil Testing Laboratory and other provincial advisory services. The nitrogen guidelines were revised in 1978 and reflect current fertility research.[2] It is unlikely that the fundamental equations derived at that time will change significantly in the next two decades.

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[1] M. Anderson and Associates. 1982. Study Element #2. Sask. Drought Proofing Studies.

[2] Hamm, J. W. and Ward, R. 1978. A Mathematical Model for Predicting Fertilizer N Requirements (Saskatchewn Soil Testing Laboratory files).

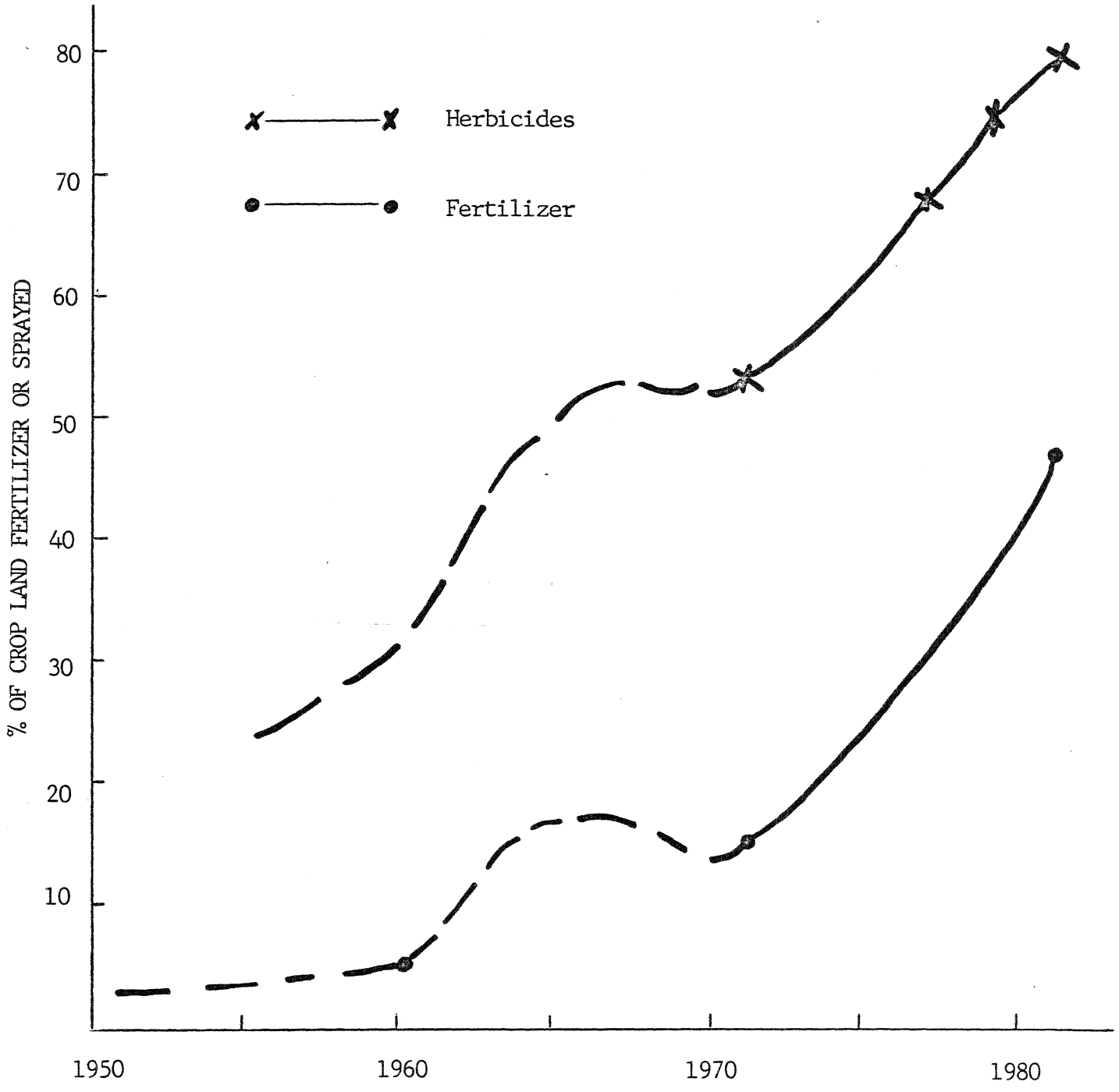

FIGURE 2.0. Relative acceptance of fertilizer and herbicides in Saskatchewan.

TABLE 2.1

AVERAGE RATE OF FERTILIZER USED AND PER CENT OF OPTIMUM IN 1981

Soil Zone	By All Farmers		By Fertilizer Users		Optimum Rate[1]
	lb/Ac	% of Optimum	lb/Ac	% of Optimum	lb/Ac
BROWN	23.1	37	65	103	63
DARK BROWN	38.0	37	80	78	103
THIN BLACK	58.1	46	89	71	126
OTHER	82.2	57	103	72	144

[1]Calculated from annual fertilizer N and P requirements. Assuming 46-0-0 as the N source and 11-51-0 as the P source.

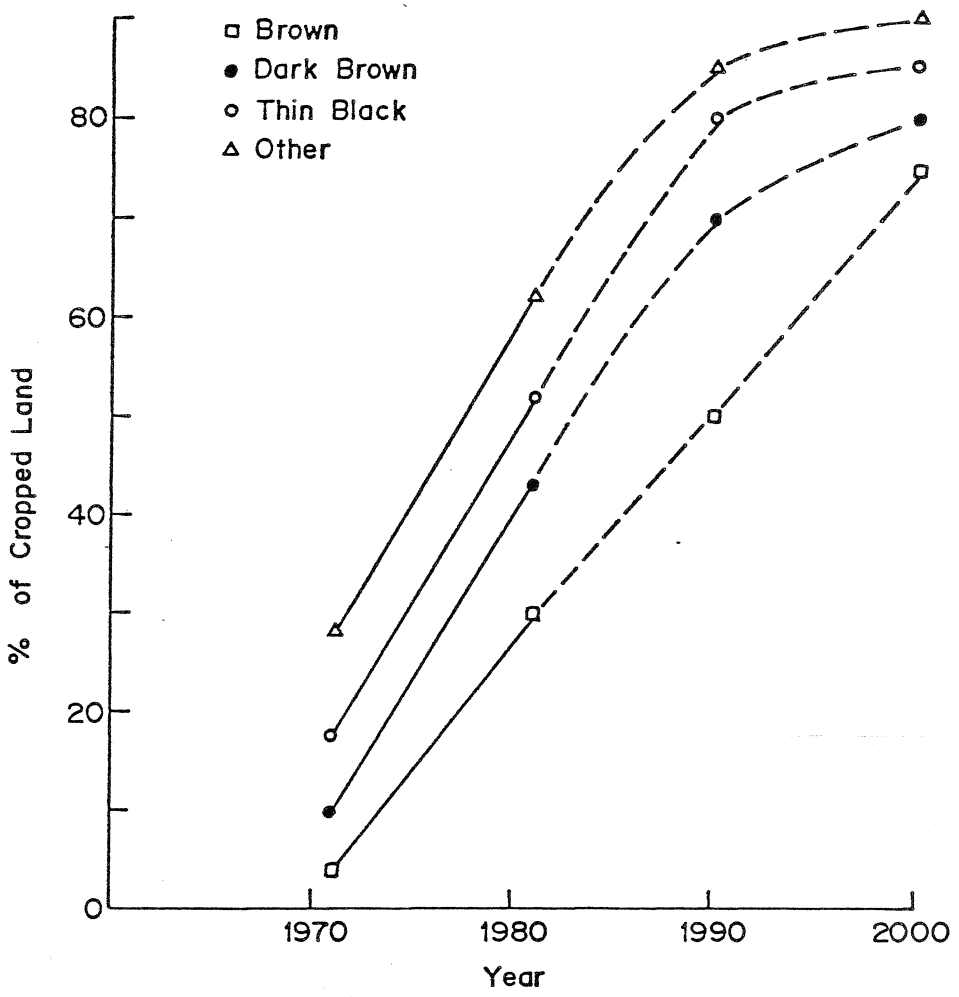

FIGURE 2.1. Proportion of cropped land fertilized in the various soil zones in 1971 and 1981 and projections for 1990 and 2000.

The phosphorus guidelines for the laboratory, however, have not been thoroughly revised since 1972.[1] Cursory examination of recent P response data, indicates that the current P guidelines are conservative and will likely be revised upward.

Given these and other considerations, projections for future N and P consumption were calculated (Figure 2.2). This exercise basically indicated a continuation of the linear trend established in the 1970's.

3.0 IMPACT ON PRODUCTIVITY AND INTENSIVE CROPPING IN SASKATCHEWAN

The increased N and P utilization will increase both summerfallow and stubble yields. However, it will have the most dramatic effect on stubble yields. Thus, the historic discrepancy between stubble and fallow returns will diminish.

The most critical parameter governing intensive vs. extensive farming practices in Saskatchewan is the ratio of stubble to fallow yields. The current (1971-81) stubble:fallow (ST/SF) yield ratios for the five major crops (wheat, barley, oats, rape and flax) and projections for 1990 and 2000 are given in Figure 3.1). The ST/SF yield ratios in the Brown and Dark Brown increased significantly in the period. However, the ratios in the more humid zones are projected to increase more rapidly and approach 1.0 by 2000 A.D. Two scenarios are given for the Dark Brown soil zone depending on the effectiveness and acceptance of minimum tillage coupled with snow trapping technology. Scenario A will be achieved with minimal effectiveness and adoption; Scenario B represents general adoption and success of these innovations.

The improved stubble productivity will impact on cropping intensity given adequate transportation and marketing infrastructure (i) guaranteed supply and N and P fertilizers and (ii) updated and adequate soil diagnostic advisory services.

Historic and projected crop rotation lengths are given in Figure 3.2. the sharp increase in stubble cropping revealed by the 1981 census is the major indicator of "the awakening" of the Saskatchewan giant. The modest increases projected for the Brown and Dark Brown zones reflect the reality of current and projected ST/SF yield ratios.

4.0 RELATIVE IMPACT OF FERTILIZER USE ON FUTURE PRODUCTIVITY

Changes in projected cultural practices will result in the following increases in crop productivity by the year 2000 A.D.:

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[1] Hamm, J. W., Henry, J. L. and Halstead, W. H. 1972. Proc. Agric. Pollution Seminar, Saskatoon.

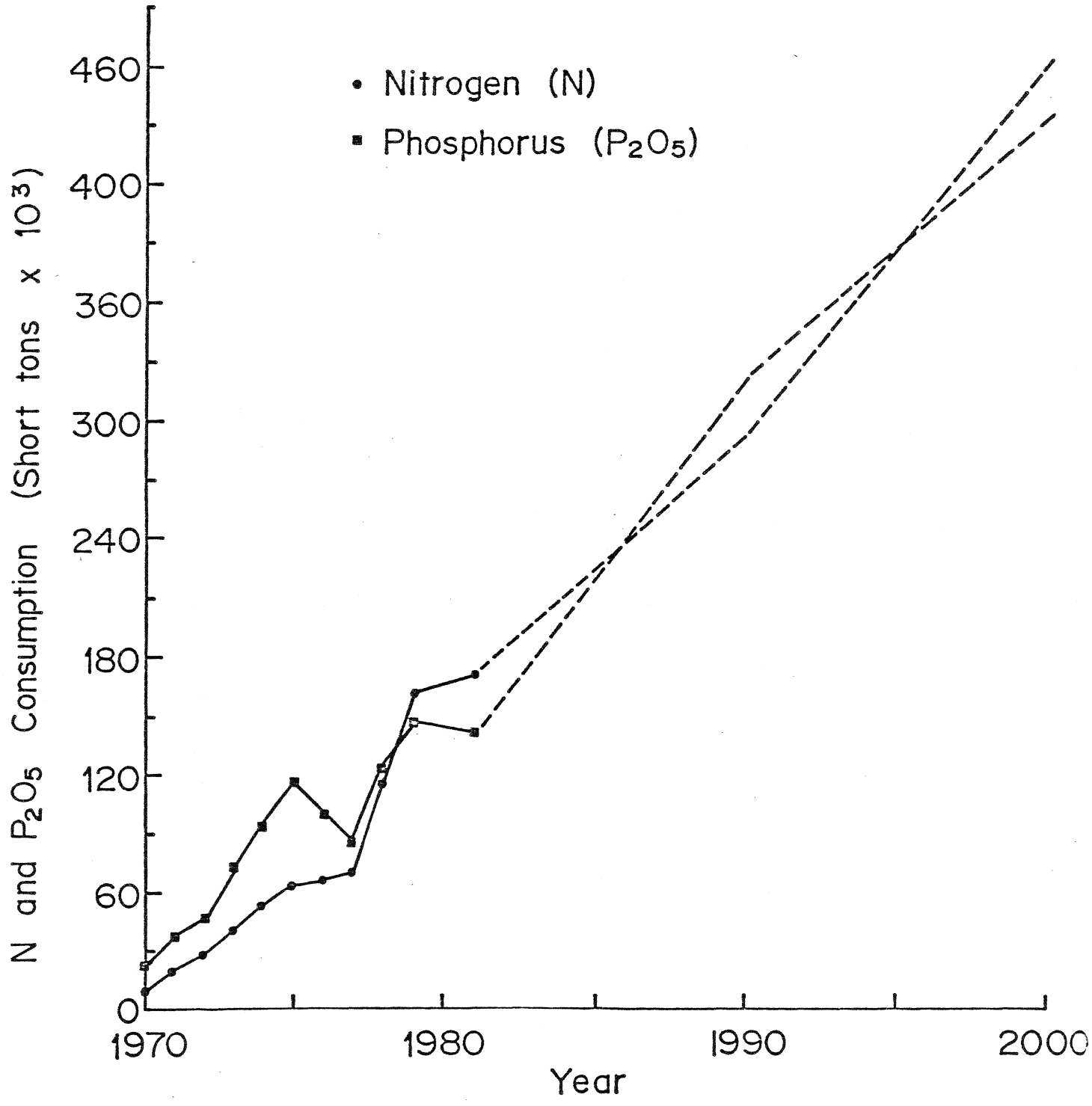

FIGURE 2.2. Fertilizer N and P projections for 1990 and 2000 based on projected levels of acceptance and rates of application.

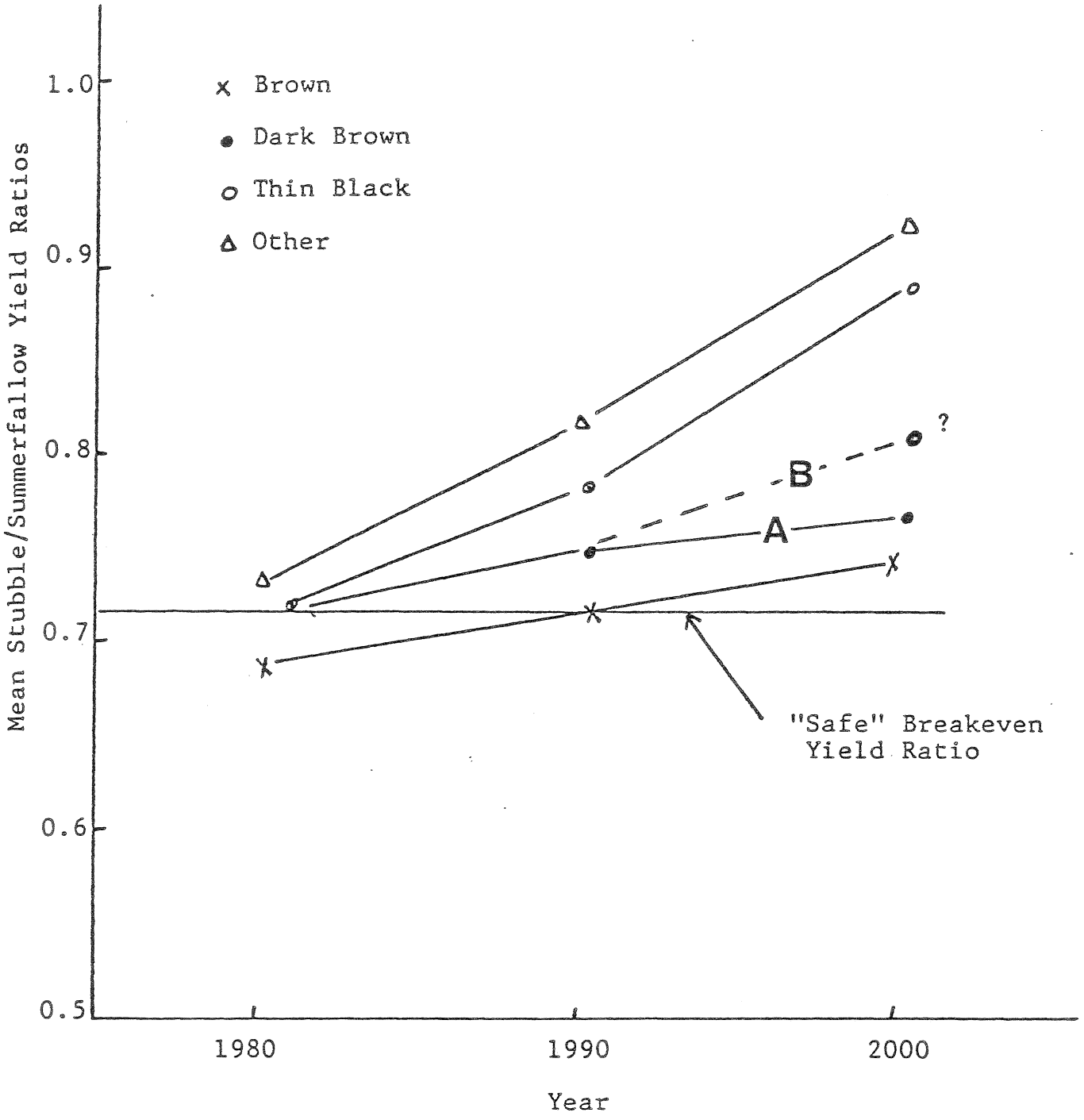

FIGURE 3.1. Changes in mean stubble:summerfallow yield ratios during projection period for major dryland crops in Saskatchewan.

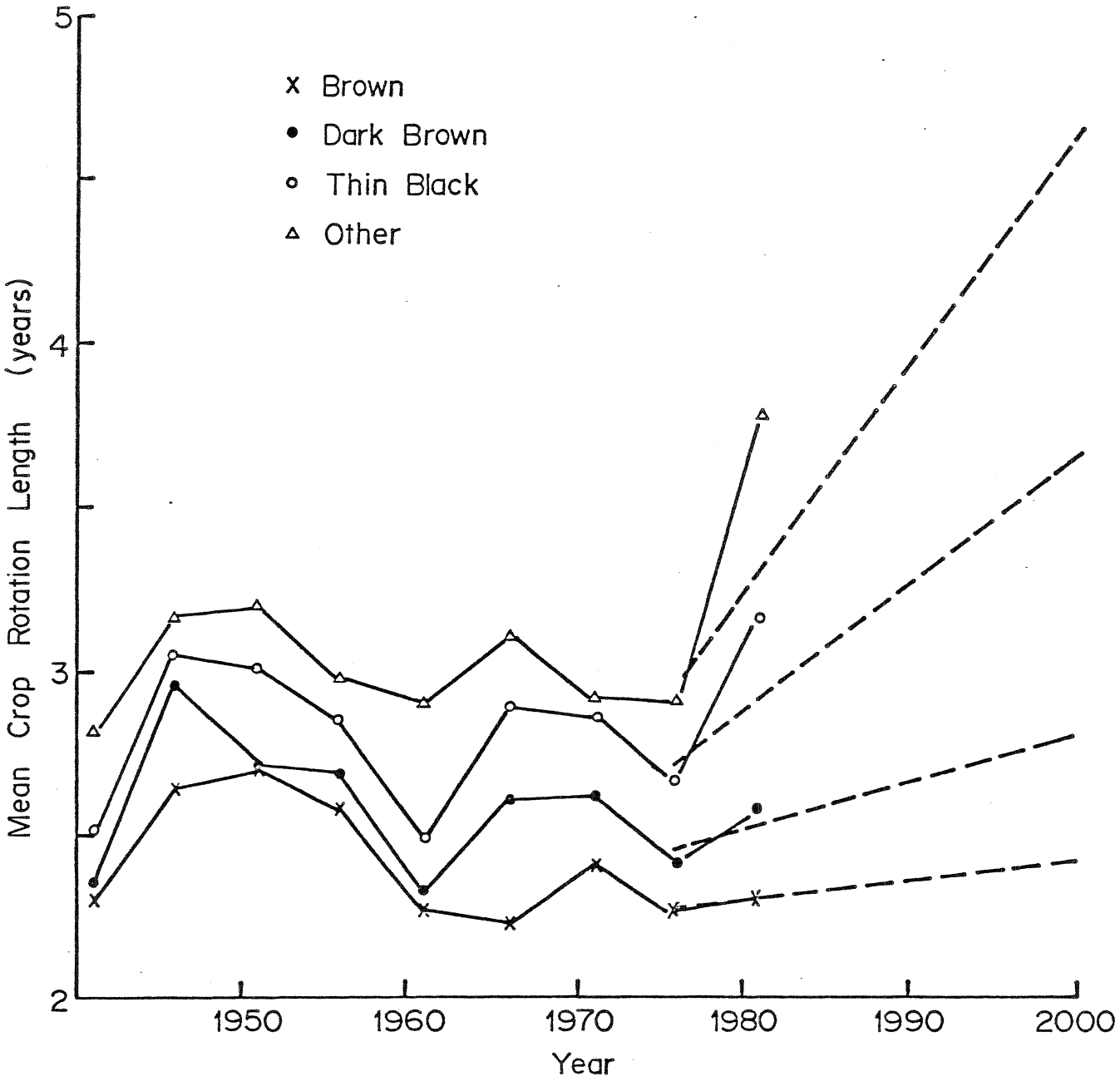

FIGURE 3.2. Historic crop rotation length and projection for 1990 and 2000.

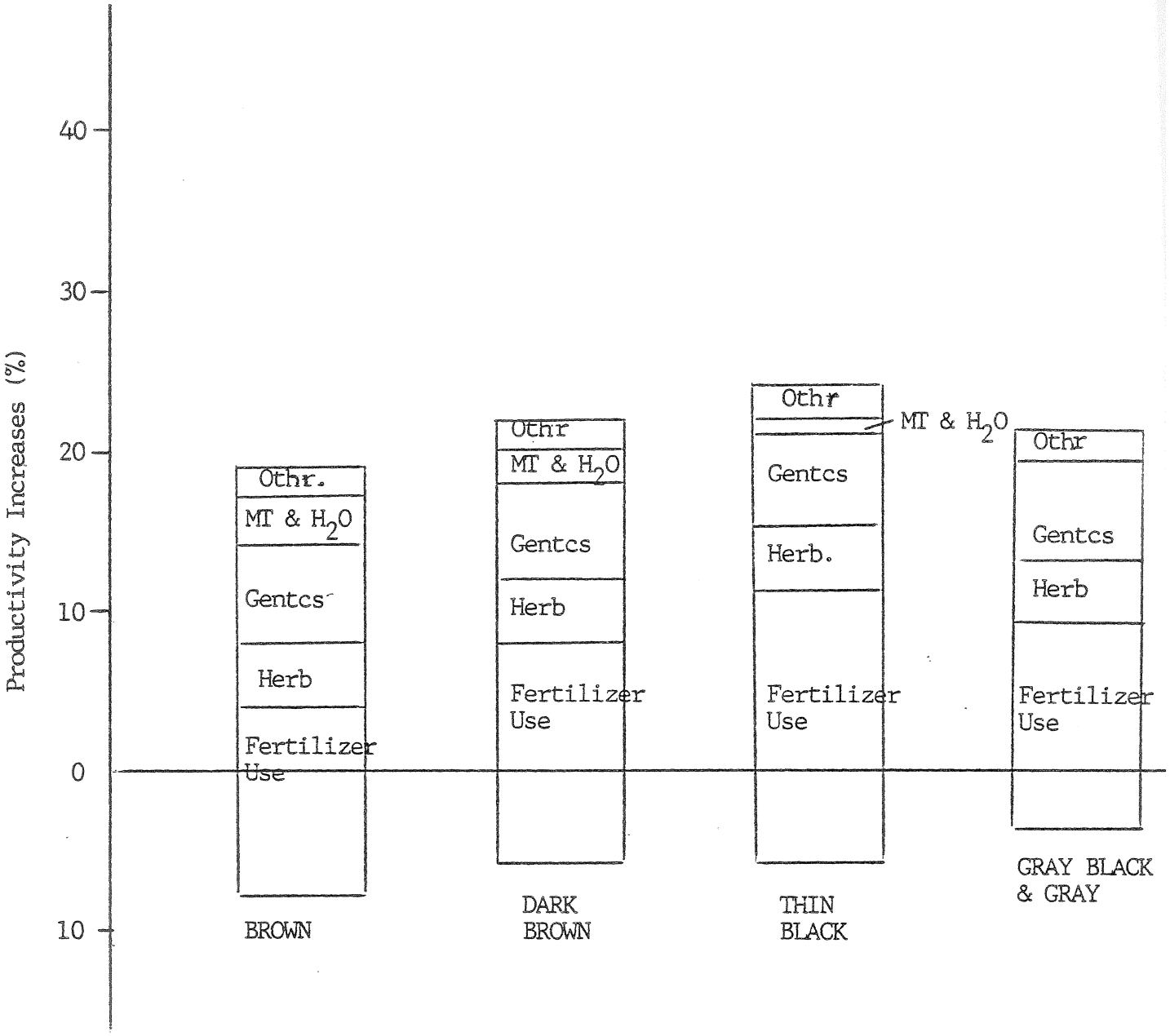

FIGURE 4.1. The relative contributions of inputs and technology to projected fallow crop productivity increases for the year 2000; corrected for soil degradation.

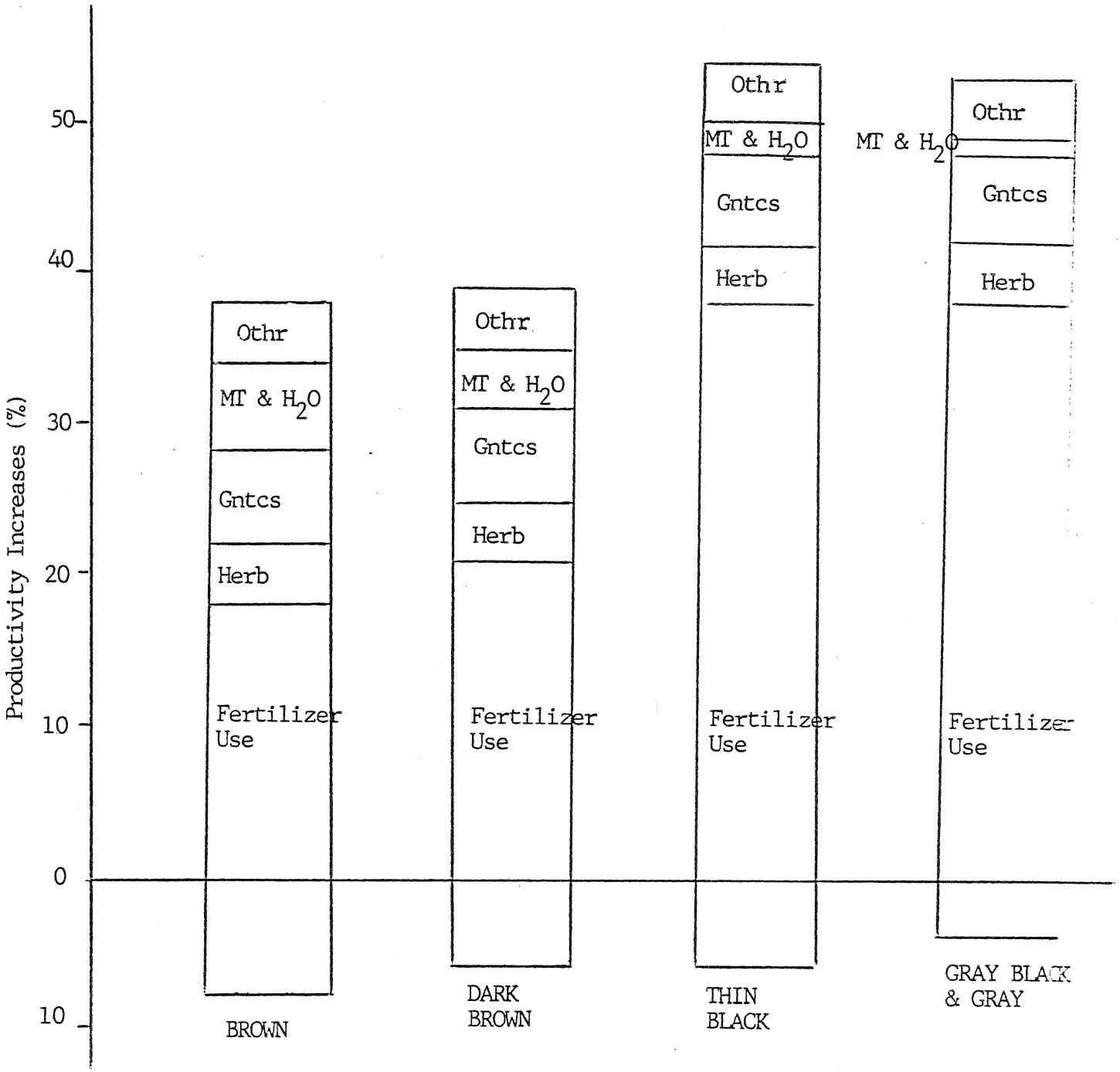

FIGURE 4.2. The relative contribution of inputs and technology to stubble crop productivity increases projected for the year 2000 A.D. corrected for soil degradation.

Soil Zone	Increase over Current Productivity (%) Summerfallow	Stubble
Brown	19	38
Dark Brown	22	39
Thin Black	24	54
Gray Black and Gray	21	53

The impact of increased fertilizer use relative to the impact of improvements in other technologies during this period are portrayed in Figures 4.1 and 4.2. Improved nutrition will be responsible for 45 to 57% of increased productivity on summerfallow and 55 to 75% of the increases on stubble. These facts raise some interesting questions regarding agricultural research and extension priorities and the supply of fertilizer nutrients during the period.

5.0 THE SOIL QUALITY - PRODUCTIVITY CONTRADICTION

It is critical to realize that the previous projection includes a discount factor for soil degradation. In essence, improved farming practices in the next two decades will more than offset soil degradation during that period!

Will this trend continue or will the insiduous degradation process eventually succeed in negating technological advances and reduce productivity to historic levels or lower.

The study team addressed these questions and found that the data base for assessing future changes in productivity in this province is totally inadequate. However, some qualitative conclusions were drawn regarding long-term productivity despite this disconcerting discovery:

Black, Gray Black and Gray Soil Zones

Sustained or increased productivity in the long term seems reasonably certain in these zones. The major factor being increased crop rotations and the associated soil conservation effects.

Dark Brown and Brown Soil Zones

Sustained annual crop production in the long term in these zones is an unlikely possibility given current technology.

Minimum tillage and water enhancement technology may stabilize production at an acceptable level in the Dark Brown soil zone. However, the same cannot be said for the Brown zone. For this zone, the projected increases for 2000 may well constitute the peak production to be followed

by an agonizing decline.

6.0 POLICY IMPLICATIONS

6.1 Fertilizer N and P Supply

Increased production in the 1980's and 1990's and sustained production thereafter will depend upon a guaranteed supply of fertilizer nitrogen (N) and phosphorus (P). The projected increases in demand will be equalled by increases in fertilizer plant capacity in Western Canada. However, there is no guarantee that Saskatchewan farmers will have access to the increased output.

Recommendation:

That the government encourage the private sector to establish fertilizer N and P plants in Saskatchewan via financial and other means in exchange for priority on output.

6.2 Soil Diagnostic and Advisory Services

The current soil testing facilities in Saskatchewan, while it offers one of the most advanced services in the Central Plains Region, is grossly inadequate. Private diagnostic services based in the United States and Alberta often do not understand the Saskatchewan system and/or provide inferior recommendations.

The provincial soils advisory service is inadequately staffed and qualified to meet the challenge.

Recommendation:

1. That the provincial government stabilize the Saskatchewan Soil Testing Laboratory and designate it as the "model" laboratory for others which operate or wish to establish in the province.

2. Provide incentive to the private sector to establish soil testing laboratories in Regina, North Battleford, Melfort, Yorkton and Weyburn. Financial incentives should be conditional on the adoption of the proven and successful system developed by the Saskatchewan Soil Testing Laboratory and the Saskatchewan Advisory Council on Soils and Agronomy.

3. Fund , via SARF or other mechanisms, fertility data analysis projects to utilize the massive amounts of current data which researchers are accumulating but which need to impact on soil test guidelines and general recommendations to farmers.

eg. a) optimum P rates for all crops
b) variable rate fertilization implications.

6.3 Soil Degradation, Fertility and Productivity Studies

The data base for assessing and projecting the effect of future crop rotations and cultural practices on the soil resource, productivity and energy consumption does not exist. Nor are the mathematical models needed to provide practical answers to the questions of long-term productivity available in usuable forms.

These questions are not new and the lack of adequate answers of an integrated and comprehensive nature suggests that our research system is not geared to handle these questions. The "publish or perish" syndrome which governs research in public institutions often results in the rejection of interdisciplinary projects of a comprehensive nature.

On the other hand, task-oriented research is ideally suited to the private sector. The private agricultural consulting industry in Saskatchewan is alive an well. However, it is rarely recognized by politicians and bureacrats alike. The situation in Alberta is considerably different. There, the Provincial Department of Agriculture and Environment have "farmed out" these questions on land use and soil management to professionals in the private sector and have received objective and reliable answers.

Recommendation:

1. That the provincial government: (i) recognize the need for interdisciplinary research in agriculture and the environment; and, (ii) establish research priorities in this regard.

2. That the government utilize the private agricultural research industry to resolve questions: (i) of an interdisciplinary nature; (ii) which are not suited to two and three year graduate student programs or, (iii) which are not otherwise compatible to existing public research systems.