Fallow: costly insurance for the Victorian Mallee?

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ABSTRACT

Long fallows provide yield stability at the cost of every second crop in the semi-arid Victorian Mallee.

Economic and environmental penalties of the long fallow wheat rotation accrue from the sacrifice of every other crop and the land is more susceptible to wind erosion and deep drainage.

Short (6 month) and long (18 month) fallows in two-year fallow-wheat sequences were simulated for the period 1939-1999 using the O'Leary-Connor fallow-wheat model. Long fallow increased soil-water stored at sowing by an average of 36 mm and increased average wheat yield by 0.5 t/ha/y. However, long fallow decreased mean yield by 0.5 t/ha/y over the 2-y production cycle. Episodic drainage was confined to the long-fallow system whereas drainage was negligible with short fallows.

Long fallow is a costly insurance for the Victorian Mallee.

KEYWORDS

Wheat, dryland salinity, short-fallow, long-fallow, semi-arid, soil water.

INTRODUCTION

Long fallows provide yield stability at the cost of every second crop in the semi-arid Victorian Mallee.

The economic and environmental penalties of the long fallow wheat rotation accrue from the sacrifice of every other crop and land which is more susceptible to wind erosion and deep drainage.

Soil water, drainage and yield of short (6 month) and long (18 month) fallow cropping systems were assessed using a fallow-wheat simulation model.

MATERIAL AND METHODS

Site

This study was conducted at Walpeup (35? 07' S., 142? 00' E., 105 m elev.: mean annual rainfall = 337 mm) in Mallee region of north-west Victoria.

Fallow-wheat model

The O'Leary-Connor fallow-wheat model (1), which was developed and validated for the Mallee environment (2), was used to examine soil water and wheat production after short and long fallows.

The analysis compared fallow performance in terms of soil-water accumulation and subsequent wheat grain yield, drainage and runoff for the period, 1939-2000.

Soil and crop data appropriate to a sandy loam (Gc 1.2) were obtained from O'Leary and Connor (2). The model was initialised assuming a typical dry soil profile at harvest (soil-water deficit = 150 mm). Daily meteorological data, were obtained for Walpeup for the period, 1939 to 2000, from the Bureau of Meteorology (Station 076064). Data described screen air and soil surface minimum and maximum

temperature; 0900 and 1500 h screen, air and wet bulb temperature; minimum, maximum, daily mean, 0900 and 1500 h relative humidity; rainfall; solar radiation and wind run.

An adequate initial soil N profile was set to avoid limitations to crop production in favourable growing seasons. Non-water benefits of long-fallows were not considered.

Total profile soil-water content (mm) at sowing and maturity, grain yield (kg/ha), runoff (mm) and drainage (mm) beyond the crop rootzone were simulated daily and summarised annually. In this study, potential simulated wheat yields are determined on the basis of adequate inputs other than water for crop growth. In practice, to insure against high input costs in drought years, Mallee farmers gear inputs accordingly, thereby placing an upper limit on potential yield in bumper years. We argue that as very few crops exceed 2750 kg/ha, this yield could be considered as an appropriate ceiling for this study.

RESULTS AND DISCUSSION

Soil-water content at sowing

The simulated soil-water content at sowing after short- and long-fallow demonstrated an average gain of 36 mm additional soil water from long-fallow. Long-fallow soil-water content averaged 212 mm (range 142-285 mm). Without long-fallow, short-fallow sowing profiles contained an averaged 176 mm (range 139-259 mm).

Drainage and runoff

Negligible (≤10 mm) excess water (drainage + runoff) under short and long-fallow wheat sequences was simulated, reflecting the low rainfall environment. The long-fallow system drained 3% of years compared to zero drainage simulated under short-fallow wheat.

Post-crop soil-water content

Most post-crop (harvest) soil-water profiles simulated were dry (≤150 mm) after wheat irrespective of fallow length (short *v*. long). The dry harvest profiles provide evidence of the 2-y production cycle being completed. Virtually no residual subsoil water remained beyond harvest irrespective of fallow length.

Crop production

Growing season (in-crop) rainfall averaged 207 mm, although variable (standard deviation of 68 mm). Sowing occurred each crop year, although drought resulted in crop failures due to sever water stress. Short-fallow wheat yield outcomes were 0 to 4100 kg/ha compared to 0-4800 kg/ha for long-fallow wheat. Wheat yields ≤1.5 t/ha were more common after a short-fallow, a consequence of low storage and drier sowing profiles.

The average annual wheat yield gain due to long-fallow was 530 kg/ha/y (2100 *v.* 1570 kg/ha) when a 2750 kg/ha yield ceiling is applied. Conversely, applying the yield ceiling, and given the 2-y production cycle under long-fallowing, fallow cropping has a mean yield penalty of 520 kg/ha/y (i.e.[2100]-[2*1570] kg/ha/2y).

Crop failure after a short fallow compared to the long fallow system was 8% greater due lower soil-water conservation and dry seasons. Nevertheless, in the long term the substitution of a crop for long-fallow effectively doubles the land area cropped and results in a yield gain of 520 kg/ha/y.

CONCLUSION

Long fallow resulted in fewer low yielding crops, but average annual total production was less than a short fallow system in the Victorian Mallee.

REFERENCES

1. O'Leary, G.J. and Connor, D.J. 1996*a. Agric. Sys.* **52,** 1-29.

2. O'Leary, G.J. and Connor, D.J. 1996*b. Agric. Sys.* **52,** 31-55.