The reliability of supply of feed grains in the northern region

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Abstract

Reliability of supply of feed grain has become a high priority issue for industry in the northern region. Expansion by major intensive livestock and industrial users of grain, combined with high inter-annual variability in seasonal conditions, has generated concern in the industry about reliability of supply. This paper reports on a modelling study undertaken to analyse the reliability of supply of feed grain in the northern region. Feed grain demand was calculated for major industries (cattle feedlots, pigs, poultry, dairy) based on their current size and rate of grain usage. Current demand was estimated to be 2.8Mt. With the development of new industrial users (ethanol) and by projecting the current growth rate of the various intensive livestock industries, it was estimated that demand would grow to 3.6Mt in three years time. Feed grain supply was estimated using shire scale yield prediction models for wheat and sorghum that had been calibrated against recent ABS production data. Other crops that contribute to a lesser extent to the total feed grain pool (barley, maize) were included by considering their production relative to the major winter and summer grains, with estimates based on available production records. This modelling approach allowed simulation of a 101-year time series of yield that showed the extent of the impact of inter-annual climate variability on yield levels. Production estimates were developed from this yield time series by including planted crop area. Area planted data were obtained from ABS and ABARE records. Total production amounts were adjusted to allow for any export and end uses that were not feed grain (flour, malt etc). The median feed grain supply for an average area planted was about 3.1Mt, but this varied greatly from year to year depending on seasonal conditions and area planted. These estimates indicated that supply would not meet current demand in about 30% of years if a median area crop were planted. Two thirds of the years with a supply shortfall were El Nino years. This proportion of years was halved (i.e. 15%) if the area planted increased to that associated with the best 10% of years. Should demand grow as projected in this study, there would be few years where it could be met if a median crop area was planted. With area planted similar to the best 10% of years, there would still be a shortfall in nearly 50% of all years (and 80% of El Nino years). The implications of these results on supply/demand and risk management and investment in research and development are briefly discussed.

Introduction

Intensive livestock industries are a major contributor to the economic well being of rural communities in the northern cropping region (Fig. 1). They are also its major consumers of locally produced grain. Over the past decade there has been substantial increase in the number of feedlots for cattle, which is the major industrial consumer of feed grain in the region. The pig and poultry industries are also major consumers of feed grains, with significant expansion occurring in the former in recent years. The planned construction of an ethanol plant at Dalby and the possible future expansion of this industry generate further demand for feed grain. These industrial users of grain require reliability of supply to ensure stability of continuous operation. Both winter and summer crops contribute to the feed grain pool in the region. Wheat and sorghum are the major feed grain crops, with barley and maize contributing significant but lesser amounts. This range of crops and production seasons generates considerable flexibility and production risk mitigation. Nonetheless, the high inter-annual climatic variability in this region, which is associated partly with the El Nino Southern Oscillation

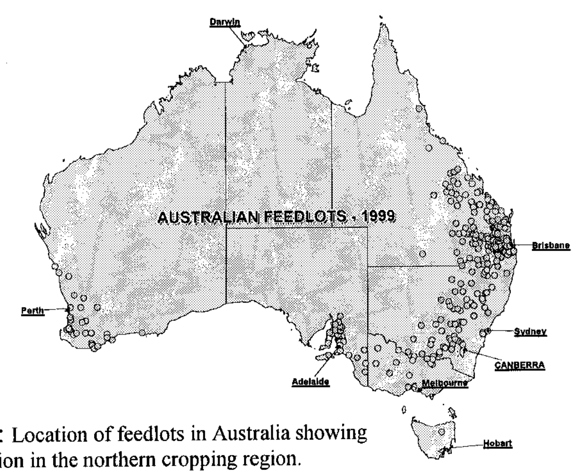

Figure 1: Location of feedlots in Australia showing concentration in the northern cropping region.

phenomenon, generates high year-to-year variability in grain production (Potgieter *et al.*, 2002). As demand for feed grain has increased with industry growth, the reliability of supply has become of concern. This concern has been exacerbated by the major drought and production shortfall in 2002. Consequently, reliability of feed grain supply has become a high priority issue for industry in the northern region. The aim of this study was to quantify the reliability of supply of feed grain in the northern region. A regional grain commodity modelling approach was adopted to underpin the analysis.

Demand for feed grain

Feed grain demand was calculated for major industries (cattle feedlots, pigs, poultry, dairy) based on their current size (number of animals) and rate of grain usage (consumption per animal) (Table 1). Data for Queensland and northern NSW were combined to obtain total estimates for the northern cropping region. Estimates for northern NSW were taken as one-third of the values reported for the state by the Australian Bureau of Statistics (ABS). On this basis current demand for the northern cropping region was estimated to be about 2.8Mt. With the development of new industrial users (ethanol) and by projecting the current growth rate of the various intensive livestock industries, it was estimated that this demand would grow to about 3.6Mt in three years time.

Table 1: Current and projected feed grain demand in the northern cropping region. Values are given for each industry for Queensland. The value for northern NSW is for all industries combined. Growth rate calculated on data over past 5 years. Values derived from ABS data.

Industry	Current Demand ('000 t)	Growth Rate (annual %)	Demand in 3 years ('000 t)
Feedlots (Qld)	1,150	7.4	1,424
Pigs (Qld)	367	10.0	488
Poultry – Meat (Qld)	239	2.5	257
Poultry – Layers (Qld)	96	2.5	104
Dairy (Qld)	184	0	184
Ethanol (Qld)			200
All industries (Qld)	2,036		2,657
All industries (NNSW)	770		947
Total	2,806		3,604

Supply of feed grain

Supply of feed grain was calculated for the major feed grain crops in the northern cropping region – wheat, sorghum, barley, and maize. A shire scale yield model was employed to predict yield per unit area for wheat (Stephens *et al.*, 2000) and sorghum for all grain producing shires in the region (Fig. 2). The shire yield model for sorghum was developed using a similar approach to that reported for wheat. A simple crop water balance and historical rainfall data were employed in a spatial modelling framework (Rosenthal *et al.*, 1998) to generate a crop water stress index, which was regressed against ABS shire yield data for the period 1983-1997. The resultant equations predicted shire yield well for each of the 32 shires involved (average R^2 of 0.74). Yield estimates were multiplied by median area planted (2.0 Mha for wheat and 0.56 Mha for sorghum) to obtain total production estimates. Median area planted was based on data for the period 1993-2002 from the Australian Bureau of Agricultural and Resource Economics (ABARE). ABARE data also indicated that, on average, 55% of wheat produced was used for feed. All of the sorghum produced was available for feed except the 22% of Queensland production that was exported.

Production estimates for barley and maize were derived from their relatively stable association with annual production of wheat and sorghum, respectively. Inspection of ABARE and ABS data indicated that barley production was consistently 20% of that for wheat and 75% of all barley produced was used for feed. For maize, total production was 20% of that for sorghum and 64% was used for feed.

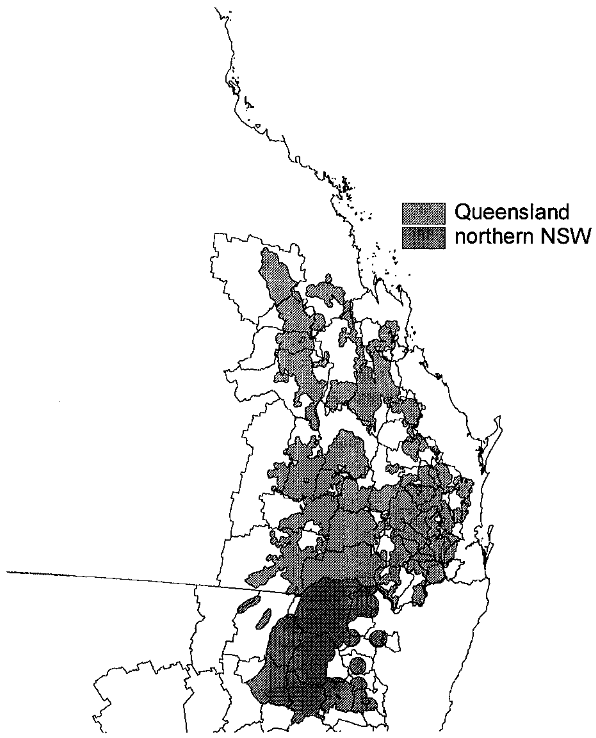

Figure 2: Location of the 32 grain-producing shires used to define the northern cropping region in this study

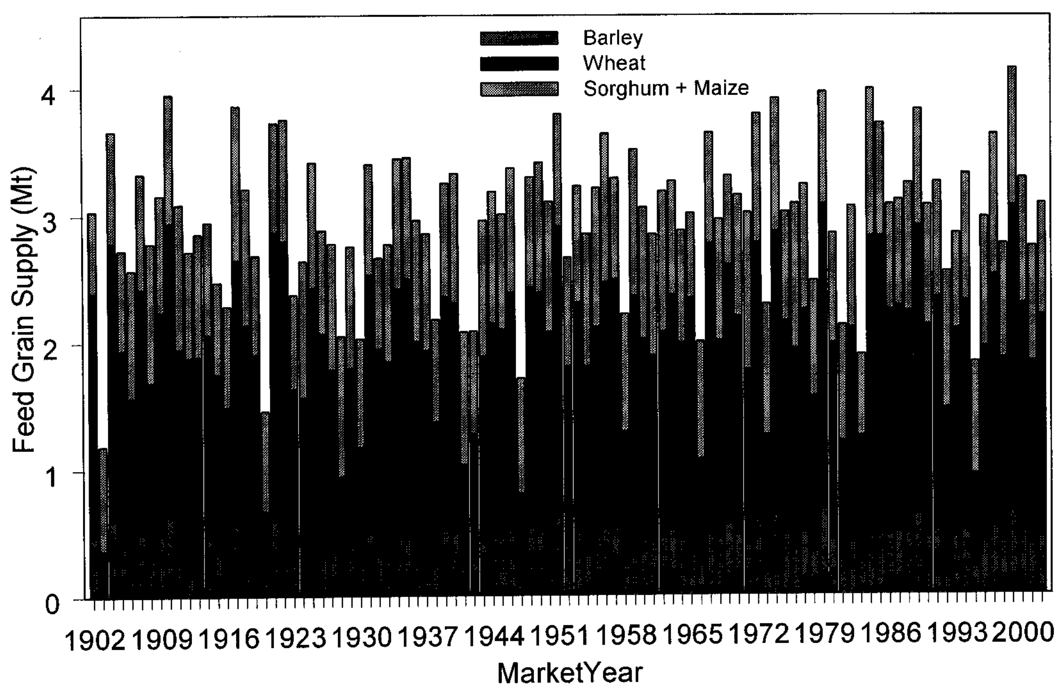

Figure 3: Simulated feed grain supply for the northern cropping region of Australia for the period 1901-2001.

A 101-year simulation of feed grain supply was conducted using these models and relationships with historical rainfall data for the region. This generated the variability in supply that could occur due to seasonal conditions given current technology and production capability. The median annual feed grain supply for an average area planted was about 3.1Mt, but this varied from 1.2 to 4.1 Mt depending on seasonal conditions (Figure 3). Variations in area planted from year to year would also affect this result. The average area planted used in this simulation (1.7 Mha) can vary by about +/- 0.5 Mha in any year depending on planting conditions and relative prices.

How often will supply meet demand?

The proportion of years in which a feed grain deficit occurred was affected significantly by seasonal conditions. While the median feed grain supply from the 100-year simulation (3.1 Mt) exceeded current demand (2.8 Mt), there were many years where this was not the case. By examining the expected deviation of annual supply from demand (Fig. 4), there were about 30% of years (32 of 101) when supply would not meet current demand. The majority of these years with a supply shortfall (21 of the 32 or 66%) were El Nino years. However, there were another 11 El Nino years in which supply was adequate. Hence, 21 of the 32 El Nino years (66%) were associated with a deficit while this occurred in only 11 of the remaining 69 years (16%). The incidence of El Nino thus substantially increases the risk (66% compared to 16%) of feed grain supply not meeting current demand in this region.

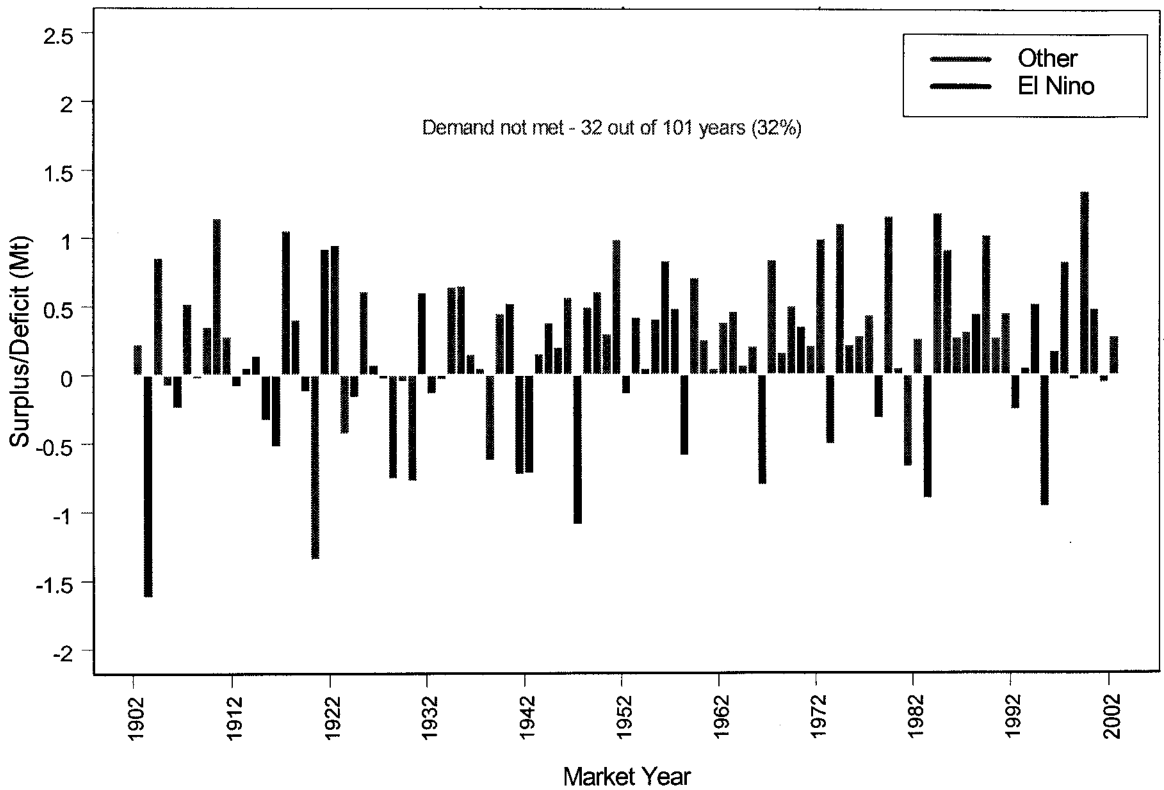

Figure 4. Annual surplus or deficit of feed grain supply over current demand (2.8 Mt) for the northern cropping region. Supply was calculated assuming a median planted area in each year. El Nino years are indicated in red.

The proportion of years in which a feed grain deficit occurred was also affected significantly by area planted. In good planting years, the area planted to wheat increased to 2.27 Mha and sorghum increased to 0.76 Mha. Under these planting conditions, median supply increased to about 3.6 Mt and current demand for feed grain was met in all but 14 of the 101 years (15%), with 9 of those 14 being El Nino years. It remains noteworthy, however, that even in years with good plantings, there remain 15% of years where capacity of local feed grain supply will not be adequate to meet current demand. In years with poor planting opportunities, crop area can be close to halved. In these years, feed grain demand will not be met. There is some indication (data not shown) that low-planted area is also related to the incidence of El Nino. This would serve to worsen the consequences of El Nino incidence noted in the analysis above.

Should demand for feed grain in this region grow over the next three years as projected in the demand analysis presented earlier, current supply capability will become increasingly inadequate. Even in good planting years, close to half (48%) of the time, demand would not be met by local production (Fig. 5). In situations with median planted area (Fig. 3), this level of demand would not be met in most (84%) years (data not shown).

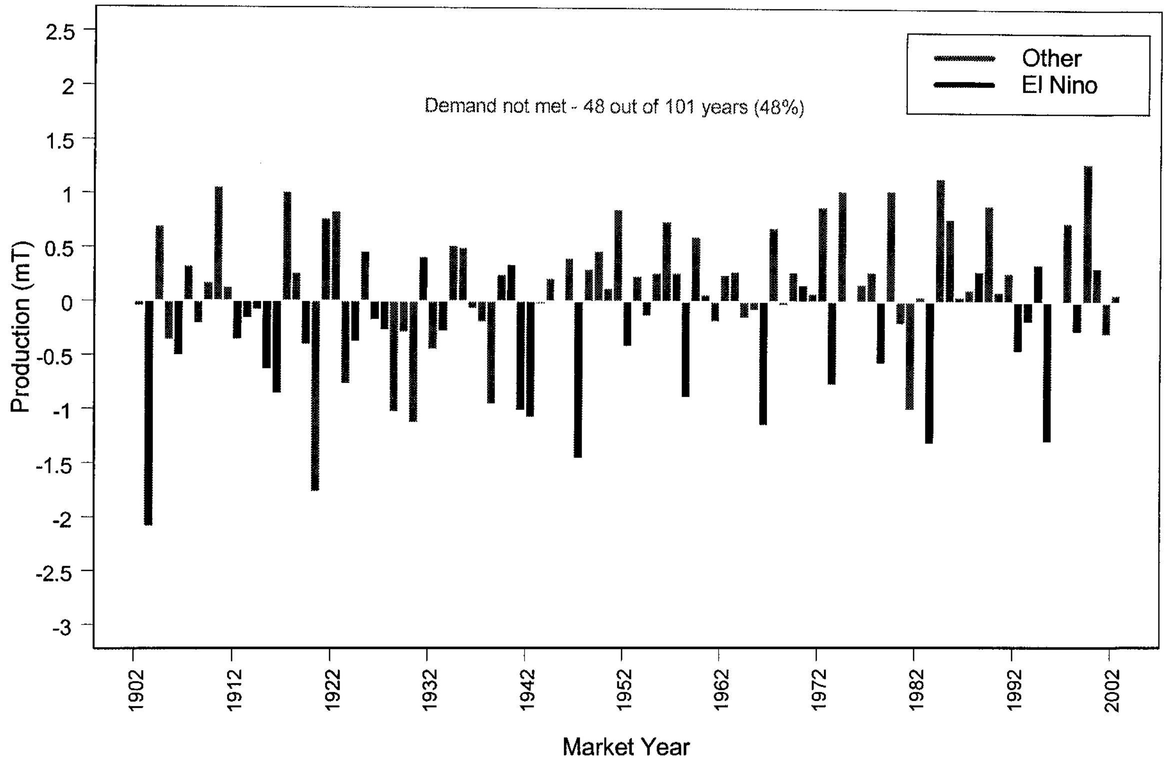

Figure 5. Annual surplus or deficit of feed grain supply over projected demand in three years (3.6 Mt) for the northern cropping region. Supply was calculated assuming a high planted area in each year. El Nino years are indicated in red.

Implications

This analysis has shown that current demand for feed grain is unlikely to be met by local supply in about 30% of years. This shortfall is reduced to 15% of years in favourable planting situations where large crop areas are planted. Conversely, the shortfall risk is increased dramatically in El Nino years (66%) or in poor planting years (100%). The analysis also indicated that this situation would worsen with projected industry growth.

Market dynamics and pricing are likely to be able to accommodate much of this variability in supply. There is considerable opportunity for supply of feed grain to the northern region from southeastern Australia. Previous studies (Gaffney *et al.*, 1994) have noted the importance of the southeastern Australian market as an important source to supplement local supplies. There is nearly always a surplus in the southeastern market. However, in years of shortfall in the northern market, the price of feed grain will increase in line with the cost of transport. The increasing growth in feed grain consuming industries suggests that they will be able to absorb these extra costs. Further analysis to incorporate considerations of supply and demand in other parts of Australia and potential and cost of inter-regional flows would be useful. This would also provide a basis for analysis of pay-off to possible investment in more efficient intra-national transport systems. Given the spatial coherence of the effect of El Nino in some years (Potgieter *et al.*, 2002), there may still be occasions where the southern market is unable to meet the shortfall. As in the current situation, it may be necessary to ensure that procedures to facilitate safe import of feed grain are in place as an ultimate back up.

While market signals via increased grain price can likely generate satisfactory solutions in the short term, there are clearly efficiencies to be gained by seeking solutions at a higher level of co-ordination. Such solutions could be sought via public and private investment in research and development. There is considerable opportunity to expand supply in the region via both planted area and yield per unit area by investing in innovative technologies to produce improved varieties and production systems. Further, given that the shortfall is episodic in nature, there are opportunities to explore inter-seasonal and inter-annual transfer systems using innovative concepts in grain storage.

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