Department of
Primary Industries and Regional Development

GOVERNMENT OF WESTERN AUSTRALIA

Growing irrigated crops and pastures in the Pilbara

At a glance

- Select fodder crops and pastures that are capable of meeting nutritional requirements of cattle
- Create a water and nutrient budget, and application schedule
- Establish a regular monitoring program for soil moisture, and soil and crop nutrients
- Cut fodder crops at the right stage to optimise the balance between yield and quality

Irrigated crop and pasture production in the Pilbara is a relatively new industry. The first water licence for irrigated agriculture was issued in the late 2000s and irrigated developments have expanded rapidly since 2013.

Crop selection

'Stand and graze' pastures and fodder crops for hay are the most common irrigated plantings in the Pilbara. These crops and pastures provide fodder for station operations such as mustering, and enable pastoral beef enterprises to finish young cattle to market specifications or improve the condition of breeding cattle prior to mating.

Irrigators should select crop and pasture species that best meet the nutritional requirement of cattle being fed. Consideration should also be given to the seasonality of crop growth and cattle feed intake requirements. Irrigators producing fodder for sale will need to ensure their product meets the requirements of the destination market.

Subtropical grasses like Rhodes grass are most popular in stand and graze systems. During the winter months growth of subtropical grasses slows, particularly in inland areas of the Pilbara.

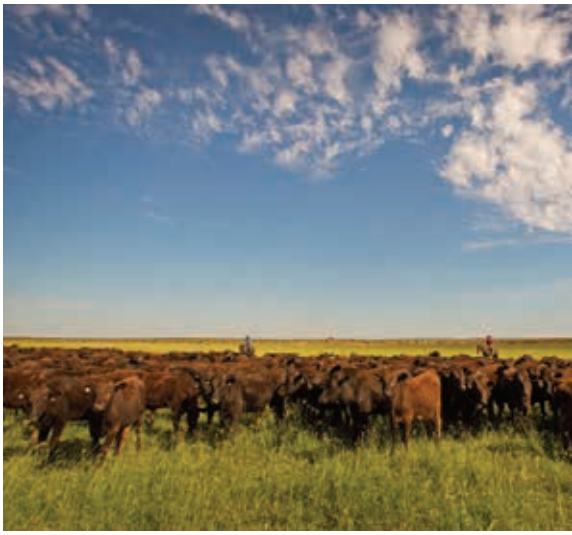
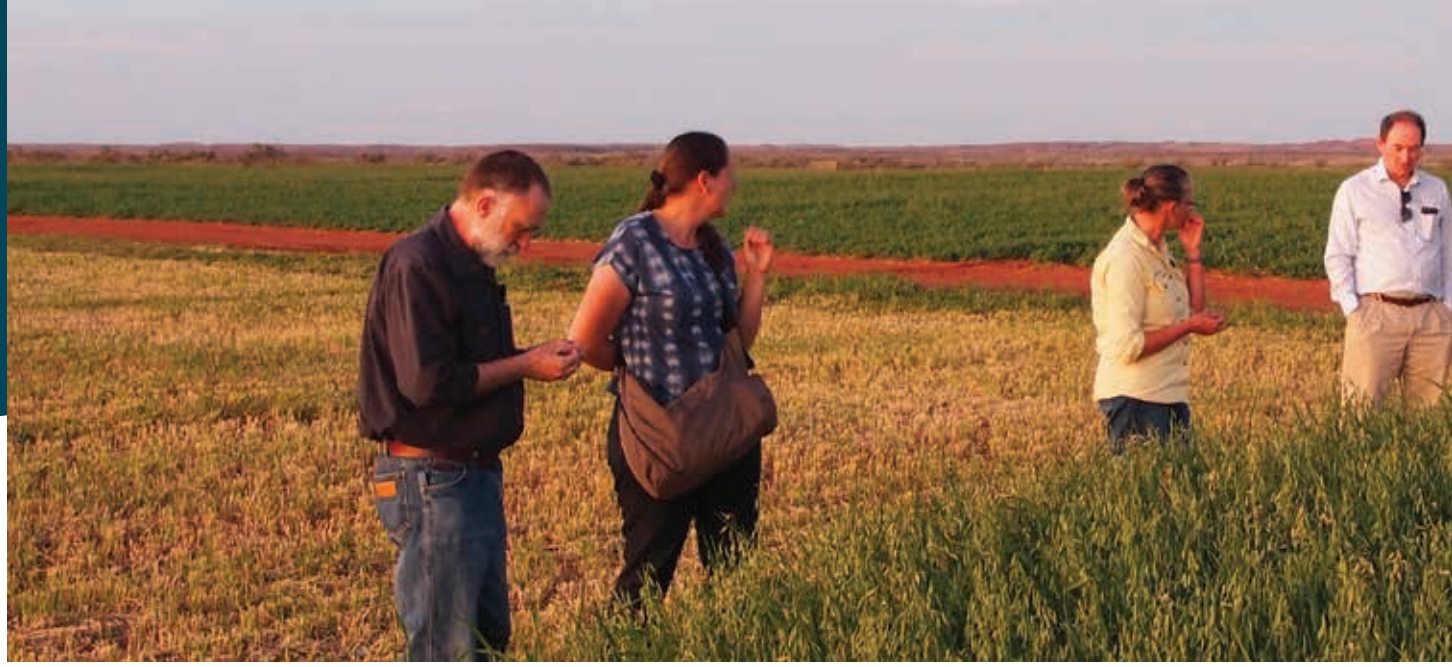


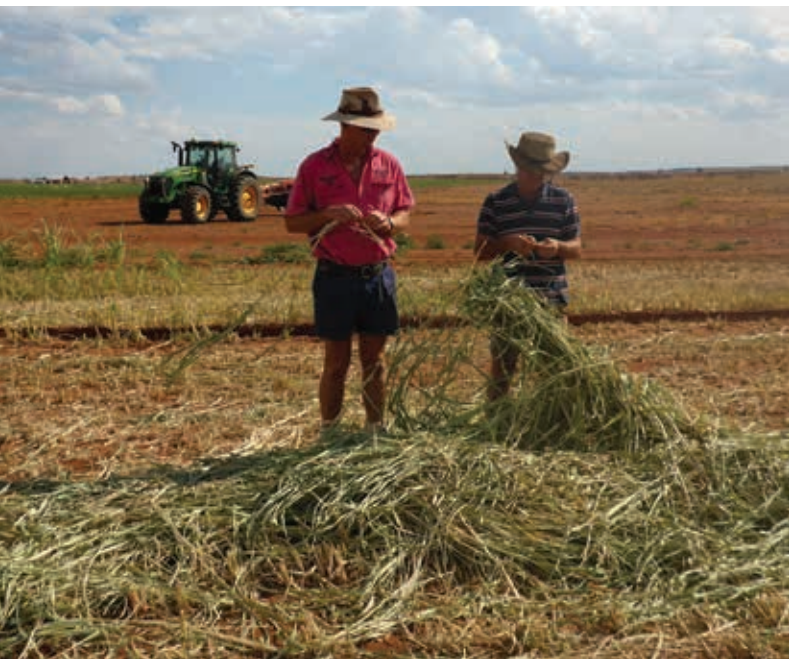
Photo right and top left courtesy: Nathon Dyer



Temperate cereals like barley and oats can be used for stand and graze in the cooler months but are more commonly grown as hay crops. Hay production over the summer months will be based on tropical grasses such as sorghum, millet and Rhodes grass.

Legumes can be used in pasture mixes with annual grass species to assist in improving soil nitrogen status and increasing the protein content of the pasture or hay but are yet to be proven in the Pilbara.

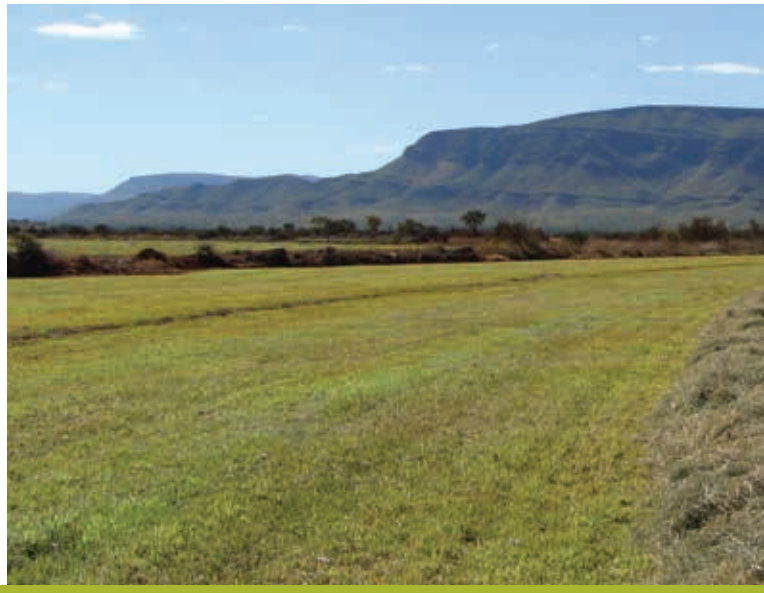
Perennial legumes such as lucerne are capable of producing high quality fodder and can also be used in stand and graze systems. Long term persistence of lucerne stands in the Pilbara is yet to be fully proven. Lucerne persistence may become problematic as this temperate species contends with the long, hot Pilbara summer.

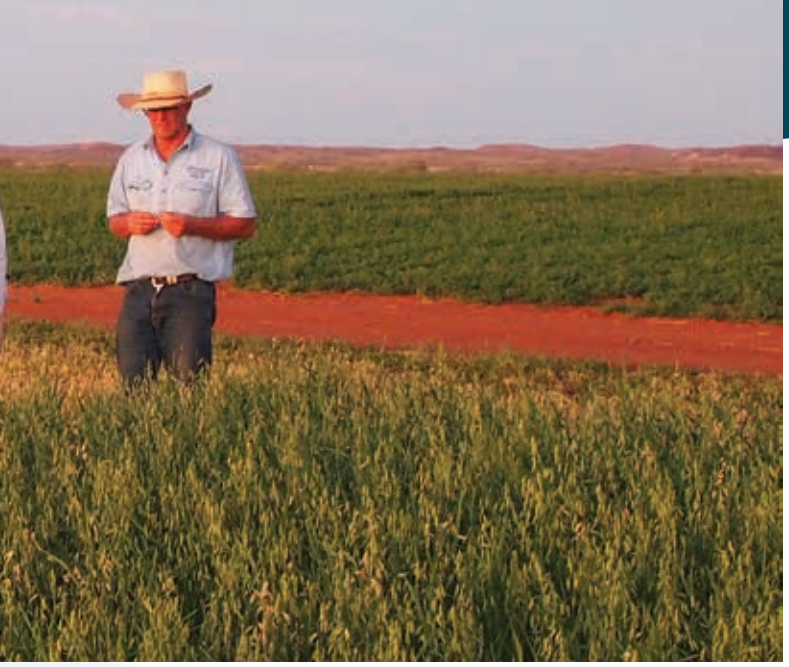


Dedicated grain crops could provide an option that allows cattle producers to grow and store high energy or high protein feedstock on property for feeding to cattle at a later date. Commercial grain crops have not been grown in the Pilbara and would require investment in grain storage facilities. Harvesting equipment would have to be purchased or contracted.

Grains such as barley, maize and sorghum are commonly used in beef feedlot rations. High energy grains can then be fed out in combination with conserved fodder in a confined feeding system.

Silage production is a further option that would allow conservation of high value feedstock that can be fed to cattle in confined feeding systems. For efficient use of silage, storage bunkers need to be close to both the irrigation area and cattle feeding facility. There are a range of crop species that could be used for silage production in both the summer and winter months including winter cereals, sorghum and maize. For increased protein content in silage mixed grass and legume crops can also be used.



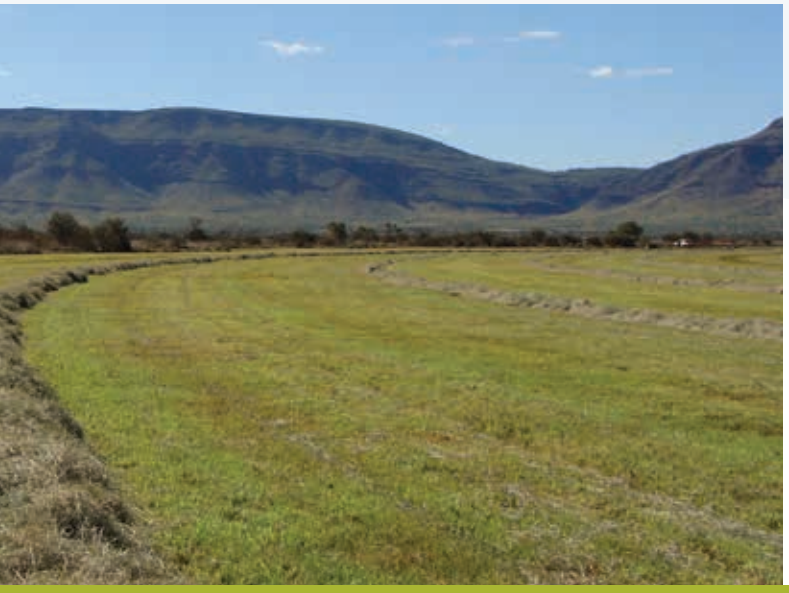


Crop and pasture yield

Production systems for irrigated crops and pastures in the Pilbara are still being optimised. Table 1 outlines the expected dry matter yield and water use for a range of species that have been used for hay production in the Pilbara.

Table 1. Estimated hay yields and water use for a selection of Pilbara grown species

Crop	Season	Dry matter yield (t/ha)	Water use (ML/ha)
Rhodes grass	Perennial	25+	22+
Lucerne	Perennial	16	25+
Oats	May–Aug	8	4
Maize	May–Aug	10	5
Sorghum	Sep–Apr	25	18+



Crop and pasture quality

Whilst high yields are important, it is equally important to ensure that the pasture or fodder being produced is of a good quality. The Australian Fodder Industry Association (AFIA) has a grading system for fodder quality. AFIA grades relate fodder quality (hay and silage) to livestock performance. AFIA grades enable instant recognition of quality by means of a simple alpha-numeric code. The grade can appear on fodder analysis reports and on Vendor Declaration Forms when selling fodder. There are AFIA grades for legume and cereal crops in the forms of hay or silage.

When growing hay crops it is important to cut the crop at the correct stage to maximise fodder quality. Often this is before the crop is flowering or reached maximum biomass. Seed suppliers can usually provide information on the ideal crop stage for hay production.

In stand and graze systems tightly grazed pastures will produce better quality feed than a pasture allowed to grow taller, transitioning into its reproductive phase. Good pasture swards can be achieved by rotationally grazing the irrigated area that has been divided into four or more cells. High intensity regular grazing encourages increased leaf production and minimises the lower quality stem component of the plants. Recent trials in the Pilbara have shown that cattle growth rates of over 700kg/hd/day have been observed on well grazed pasture.

Photo above courtesy: Ben White

Photo courtesy: Brenda Powell

Crop water requirements and scheduling irrigation

Crop water use is determined by environmental factors related to climate and weather and plant factors related to the type of crop, its stage of growth and vigour. Temperature, wind speed, solar radiation and relative humidity determine the amount of water required for productive plant growth. Weather stations measure these environmental factors and calculate evapotranspiration (ET_o). Evapostranspiration is the calculated water loss from a reference grass species.

As plants grow larger, produce more leaf area, start producing fruit or approach maturity, the proportion of ET_o will change and will therefore require a change to irrigation.

Differences in water requirements and the proportion of ET_o to be replaced are called crop coefficients (K_c). The K_c values are assigned to key stages of crop development. See example Table 2.

Daily water use is calculated from weather data and crop stage.

ET_o data can be sourced from the Bureau of Meteorology or commercial weather services. Crop coefficients are available for a range of commonly grown crops and pastures. There are commercial providers that can provide location and crop specific daily reports to enable irrigation scheduling.

Irrigation schedules should be coupled with soil moisture monitoring equipment to ensure that crop water demand is being met and water is not leaching below the root zone.

Table 2. Example of a crop coefficient (Kc) table for establishment of Rhodes grass pasture for fodder production

Crop stage	Crop coefficient (K_c) to be applied to ET_o	Number of days in crop stage*
Planting and establishment	0.4	30
Rapid growth	0.9	30
Mid to late growth	1.2	21
Harvest	0.4	4
Average for ongoing cycles of fodder production	0.95	32

*Crop stage length subject to climatic conditions. Stages may be shorter in summer and longer in winter.

Formula for crop water use:

Daily water use (mm) = Evapotranspiration (mm) x crop coefficient (K_c)

Crop nutrition

A crop nutrient budget and fertiliser application schedule will ensure crops and pastures perform to a high standard and produce good quality fodder. High growth rates, particularly over the summer months drive crop nutrient demand, in particular nitrogen. Significant fertiliser inputs are required to ensure these high yielding crops meet quality targets. Indicative nutrient requirements for a high yielding, high quality sorghum fodder crop are shown in Table 3. Nutrient inputs constitute a significant component of the cropping budget and with the additional costs of freighting fertilisers to the Pilbara consideration must be given to ensure that the most cost effective form of nutrient is being applied to the crop. This may mean the use of a combination of granular products that are drilled into the soil at sowing or top dressed as the crop is developing. It may be more cost effective to deliver some nutrients, particularly micronutrients by fertigation whereby soluble fertilisers are injected into the irrigation water to be distributed on the crop.

A regular crop nutrition monitoring program will ensure that nutrient applications are on target and not limiting crop performance. Commercial service providers can also provide tailored advice to irrigators on the development and monitoring of crop nutrition.

Pest and diseases

Pilbara irrigators have experienced locust or grasshopper pests. There are a number of chemical management options should these pests start to cause economic damage. Irrigators will need to monitor cockatoo populations should they wish to produce grain crops in the Pilbara. Cockatoos damaged millet and winter cereal crops grown at the Woodie Woodie research site as seed heads began to mature. Rotation of crop species will assist in mitigating the build-up of soil pathogens and crop residue borne diseases.

Table 3. Nutrient removal by a typical well managed sweet sorghum fodder crop. (Nutrient requirements are subject to pre-planting soil nutrient status)

Nutrient	Nutrient removed per tonne of dry matter (kg)	Fertiliser required to deliver required nutrients for a 20t/ha crop (kg)	Fertiliser product to supply major nutritional element
Nitrogen (N)	20–30	900–1300	Urea
Phosphorous (P)	2–4	180–360	Mono-ammonium phosphate (MAP)
Potassium (K)	15–20	600–800	Muriate of potash
Sulphur (S)	1.2–2.5	–	Supplied in MAP
Calcium (Ca)	3	–	Supplied in MAP
Magnesium (Mg)	3	400	Magnesium sulphate

Photo above courtesy: Brenda Powell

Find out more

Please visit the Department of Primary Industries and Regional Development website for more information on irrigated pastures and crops in the Pilbara or to download a copy of the report *Growing the Pilbara*.

Visit: **www.dpird.wa.gov.au**

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