

Don't underestimate the value of pulse production

Many SA farmers are unaware of the profitability and other benefits of pulses such as cowpea, groundnut and soya bean. As a result, these plants are neglected as crop alternatives, says **Phonnie du Toit**, chief research technician at the Agricultural Research Council in Potchefstroom.



Pulses improve soil fertility through their special ability to fix atmospheric nitrogen (N) in the soil. Nitrogen forms a major component of chlorophyll, which is crucial for photosynthesis. In this process, sunlight is used to convert water and carbon dioxide into food sugars such as glucose, which are vital to the growth and development of the plant. Nitrogen also forms a major component of amino acids, the building blocks of proteins.

PESTS AND DISEASES

Used in crop rotation, pulses help reduce losses caused by pests and diseases. For example,

if groundnut is rotated with maize infested with *Diplodia*, inoculum levels will decrease over time because the pathogen infects only the maize. Inoculum levels are the infective structures of a disease remaining in the plant residue and soil where the previous host plant was grown. Rotating with groundnut ensures that the pathogen does not have a host, which diminishes inoculum levels. Witchweed (*Striga*), a parasitic weed, remains a problem in some developing grain production areas of South Africa. Host crops such as maize and sorghum release an exudate stimulating the witchweed parasite to penetrate their roots.

ABOVE:
A well-spaced stand of cowpea. Pulses such as this improve soil fertility by fixing atmospheric nitrogen in the soil.
COURTESY OF ARC

Pulses such as groundnut and cowpea are non-hosts of *Striga*, yet trigger 'suicidal' germination of this weed, and in this way significantly reduces infestation.

PRODUCTION CONDITIONS

Soya bean, dry bean (sugar bean), groundnut and cowpea all require deep, well-drained soils, but vary in their climatic requirements. For example, dry bean does not do well in Limpopo during summer (mid-November to mid-March). Groundnut does not thrive in the Ermelo area in Mpumalanga, as the temperatures are too low, the daylight period too short and the humidity too high. However, dry bean is grown successfully in Limpopo during



FAST FACTS

- Including pulses in a crop rotation cycle can reduce the need for chemical fertiliser application.
- Pulses help improve soil fertility by fixing atmospheric nitrogen in the soil.
- Rotating pulses with grain crops such as maize can break pest and disease cycles, lowering the need for chemical control.

winter under irrigation in frost-free areas, as illustrated in Table 1.

A wide range of pulse varieties is available in South Africa. The ARC-Grain Crops Institute runs a comprehensive programme to evaluate cultivars for their adaptability and characteristics in the respective production areas. During this evaluation, cultivars that obtain the best yield and quality for a specific locality within a specific geographical area are identified.

INPUT COSTS

The seed of certain pulses has become an expensive input. For example, soya bean and dry bean seed can cost up to R2 250/ha and R3 307/ha respectively (see Table 2).

Soya bean is usually planted at a density of between 300 000/ha and 350 000/ha, with a seed spacing of 30mm to 35mm and 900cm between the rows. To achieve this requires 65kg/ha to 85kg/ha of seed. At current prices, this means an average seed cost of R2 250/ha.

ABOVE:
Harvesting pulses.

ABOVE RIGHT:
Dr Nemera Shargi and Paul Rantso, plant breeders at the ARC, inspecting a cowpea land at Ratanang near Tzaneen. A wide selection of cowpea varieties is being evaluated by the ARC.
COURTESY OF ARC

Table 1: Soil requirements, suitable production areas and optimal planting dates for soya bean, dry bean and groundnut.

Crop	Soil requirements	Optimal planting period
Soya bean	Sandy loam to sandy clay (15% to 50% clay)	Moderate areas (North West): mid-November to mid-December Colder areas (Eastern Free State, eastern parts of Mpumalanga): end-October to end-November
Dry bean (sugar bean growing season: 109 to 121 days)	Sandy loam to sandy clay loam (15% to 35% clay)	Mid-November to end-December
Groundnut	Loamy sand to sandy loam (10% to 20% clay)	Mid-October to mid-November

*Based on farmers' selection of crops most suitable for a specific area.

Dry bean is planted at a density of 150 000/ha to 200 000/ha (75mm apart and 900mm between rows). Between 13 and 14 seeds/m² are used. Seed cost averages R3 307/ha.

and 50mm, depending on soil moisture and clay content, for even germination. Ideally, a fully adjustable planter should be used to plant the crop at the required plant density and depth.

PULSES ARE THE IDEAL CROP FOR ROTATION SYSTEMS, AND A WIDE RANGE OF VARIETIES IS AVAILABLE

The ideal density for upright cowpea is 122 000/ha, while the ideal for runner cowpea is 88 000/ha. Upright growers are planted at a seed spacing of 90mm and runners at a spacing of 125mm. The average seed cost for uprights is R450/ha compared with R300/ha for runners.

The planting procedure and seed quantities should be planned with care. Planting depth should be between 20mm

Unfortunately, many subsistence, small-scale and new farmers will have trouble achieving this due to inadequate mechanisation.

FERTILISATION

As mentioned, legumes fix atmospheric N to make it available to follow-up crops, reducing the need for chemical fertiliser. These characteristics make pulses the ideal crop to be included in crop rotation systems.



Table 2: Direct variable production costs for dry beans (sugar bean)

Input item	Specification	Quantity/ha	Unit price (R)	Cost (R/ha)
Seed	RS6	65kg	1 225/25kg	3 185
Mechanisation	Diesel & repairs	-	-	1 045
Fertiliser	3:2:1 (32)	200kg	313/50kg-bag	1 252
Herbicide	Bateleur Gold	1,5ℓ	2 038/5ℓ	611
Disease control (seed dressing)	Celest XL and Apron XL	81mℓ 7mℓ	625/1ℓ 1 398/250mℓ	51 39
Treatment: bean rust	Sparta plus	500mℓ	1 298/5ℓ	130
Treatment: anthracnose	Amistar Top	500mℓ	4 576/5ℓ	457
Labour	Temporary workers	-	-	1 560
Total				8 330

Table 3: Average yield and producer prices received for maize, soya bean, groundnut and dry bean from 2013/2014 to 2015/2016

Crop	National average yield for 2011/2012 to 2015/2016 (t/ha)	Producer price in R/t*/production season		
		2013/2014	2014/2015	2015/2016
Maize	4,33	2 626	2 379	3 529
Soya bean	1,55	5 549	4 732	6 217
Groundnut	1,10	8 756	8 234	7 582
Dry bean	1,03	12 277	10 957	12 965

*Adapted from 'Trends in the agricultural sector', 2016, DAFF
 *Income depends on product quality and various grades

In addition, seed can be inoculated at low cost before planting. Soya bean and groundnut should be inoculated with *Bradyrhizobium japonicum*, a specific bacterial strain developed for soya bean. Without the inoculation, expensive inorganic N fertiliser is needed. Dry bean seed is

usually not inoculated because of its relatively short growing season (115 days to maturity compared with 136 days in the case of soya bean). On the other hand, some dry bean farmers use *Rhizobium leguminosarum*, developed specifically for dry bean, as an alternative to the traditional recommended

ABOVE LEFT: Alfred Masiha (ARC-Grain Crops) determining the plant density in a dry bean land in Mpumalanga.

ABOVE: Pulses are excellent sources of protein and fibre as well as vitamins and minerals. COURTESY OF ARC

N fertilisation programme. The economic value of inoculation and N fixation in the production of dry beans require more research.

All South African soils are inherently low in phosphorus (P). Pulses can, nonetheless, grow well provided the P level is at least 25mg/kg. At a P level of 15mg/kg or lower, a P build-up programme is needed.

Soya bean can utilise potassium (K) reserves in the soil well. In general, however, pulses are likely to show deficiencies of K in soils with less than 60mg/kg K. Pulses planted in soils with low K levels will react well to K fertilisation.

YIELD POTENTIAL

Compared with maize, the yields of pulses are relatively low (Table 3). However, income earned from these commodities, compared with income earned for maize compensates for this, as shown in Table 3. Given the decrease in the producer price of maize during October 2017, pulses are a viable alternative crop.

Diversification with pulses in an existing cropping system could decrease risks in terms of inputs, yield and income. For example, a dry bean crop can yield up to 1,25t/ha. – Annelie Coleman

• Phone Phomnie du Toit on 018 299 6288, or email him at dutoitapn@arc.agric.za. ■ FW