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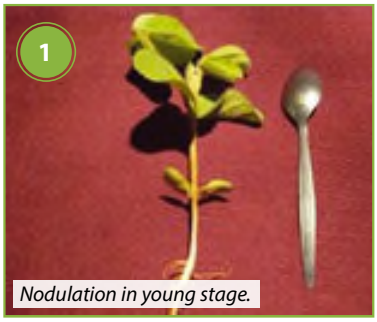
Increasing SOYA BEAN YIELD

With substantial research on soya bean cultivation, yields of above 5,5t/ha and even above 6t/ha are often achieved under irrigation nowadays. There is, however, still room for improvement and if the farmer can correctly follow the basic principles, yields can increase even further. The five main cultivation factors in order of importance are:

- Good inoculation.
- Good weed control.
- Good planting techniques.
- Good soil fertility.
- Good disease and pest control.

Inoculation

Soya beans should be properly treated annually with quality *Bradyrhizobium* inoculant from reliable suppliers – whether with inoculant on the seed or in the furrow, or both in the case where soya beans are cultivated for the first time or when extreme heat conditions occur during planting.



Nodulation in young stage.

Effective nodulation.

When soil contains little or no residual nitrogen, up to 20kg N/ha can be applied at planting to bring about initial more rapid growth. Early nodulation (plants between 8 and 10cm high) is ideal and on bigger plants the nodules should be arranged widely and around the taproot (*Photos 1* and *2*).

Weed control

There should never be a weed larger than 2,5cm on soya bean fields. Since soya is already planted at tremendous high densities, it should not also have to compete with weed. Pre-emergence weed control with a good broad-spectrum herbicide is non-negotiable. With good initial weed control it is only necessary to do at most one glyphosate spray application (*Photos 3* and *4*).

Good control of sedges.

Only pre-emergence weed control.

It is advisable to also avoid ever planting in weeds. In *Photo 3* it can be seen that the soil behind the irrigation pipe is cultivated better than where the proof is located in the foreground. Notice the excellent weed control that was obtained – sedges exclusively in this case. In *Photo 4* good pre-emergence control was done with no other follow-up weed control at this stage.

Planting techniques

Factors that play a huge role at planting time are:

- **Planting depth:** Plant between 2 and 4cm, depending on the soil's moisture content.
- **Planting speed:** Plant at less than 7km/h for better placing of seed.
- **Emergence of plants at the same time:** From breaking ground until all the plants are out, growth has to take place within 24 hours and this is achieved with even planting depth and seed size.
- **Plant population and row width:** Use *Table 1* to determine which plant population is optimal with different row widths. Cultivars differ with regards to optimal plant stand. It is advisable to contact the seed company for more information. Early determined growers that usually have an upright way of growth, are planted at plant stands of 400 000 and more. Undetermined growers with more bushy growth can, depending on the number of side branches that are formed, have as few as 180 000 plants/ha as final plant population.

It is generally advisable to have at least 240 000 plants/ha as final plant population. It is important to always plant approximately 10 to 15% more seed than the intended plant population, depending on the germination vigour of the seed and on weather conditions.

Inside row spacing: More than 23 plants per running metre causes interplant competition to occur, giving rise to the suppression of certain plants that then eventually have no or little contribution

to final yield. Compare *Photo 5* (farmer) with *Photos 6* and *7* (ideal) where plant populations are close to identical, but poor inside row spacing by the farmer has led to poor yields.

Poor inside row spacing.

Good inside row spacing.

Proper inside row spacing leads to better harvests.

Soil fertility

Good inherent fertility of the soil where soya beans are planted is essential. The soya on *Photo 8* was planted without any fertiliser, but the soil fertility is high and residual nutrients were effectively utilised. It is, however, vital to always fertilise soya beans and to ensure that the soil's nutritional status is kept at an optimal level.

Soya without fertilisation, yet the soil's inherent nutritional status is good.

The nutritional needs of soya beans are high and each ton of grain removed per hectare will withdraw the following quantities of nitrogen (N), phosphorus (P), potassium (K) and sulphur (S) from the soil.

- Nitrogen (N): 75–105kg N/ha.
- Phosphorus (P): 8–9kg P/ha.
- Potassium (K): 25–40kg K/ha.
- Sulphur (S): 9kg S/ha.

An ideal soil analysis should resemble the following:

- A pH (water) of between 5,8 and 7,2.
- P value of more than 25mg/kg (Bray 1 method).
- K values of above 80mg/kg for sandy soils with less than 15% clay, above 100mg/kg for loam soils with clay percentages of between 15 and 25% and above 120mg/kg for clay soils with clay percentages above 25%.
- S value of 25–125mg/kg.

Phosphorus and potassium

Soya beans are able to make good use of residual P and K in the soil. It is therefore

Table 1: Choice of plant population for certain row widths.

	Population					
	150 000	200 000	300 000	400 000	500 000	600 000
Row width	**Number of seeds per metre with distance between seeds (cm)**					
38cm	6 (16,6)	8 (12,5)	11 (9,1)	16 (6,25)	19 (5,3)	23 (4,38)
45cm	7 (14,3)	9 (11,1)	14 (7,14)	18 (5,55)	23 (4,35)	27 (3,70)
52,5cm	8 (12,5)	11 (9,1)	16 (6,25)	22 (4,55)	26 (3,85)	32 (3,13)
60cm	9 (11,1)	12 (8,33)	18 (5,55)	24 (4,17)	30 (3,33)	36 (2,78)
76cm	11 (9,1)	15 (6,67)	23 (4,35)	30 (3,33)	38 (2,63)	46 (2,17)
90cm	14 (7,14	18 (5,55)	27 (3,70)	36 (2,77)	45 (2,22)	54 (1,85)

Legend:

Recommended *Problem escalates* *Maximum/minimum* *Not recommended*

Notes: The number of seeds per running metre should preferably not be more than 30 (optimum 23) and not fewer than 10. Seeds closer than 3cm from each other cause excessive inside row competition, and further than 10cm will not emerge properly.
Row width therefore determines choice of plant population. Plant population as recommended by seed company.
Quick upright types – plant population of more than 400 000 seeds/ha.
Bushy types – plant population of 180 000 to 350 000.
Plant density signifies number of seeds planted and plant population means number of seedlings.

crucial that in case soya is planted for the first time on a field, the fertility levels of especially these two elements have already built up to optimal levels as mentioned earlier.

The best method of application of these elements (broadcasting versus band placing) is still being researched, especially since it is clear that soya beans prefer P in the entire volume of soil in which they grow but that K is better absorbed in a high concentration band according to the literature.

> There are good critical values for all the macro- and micro-elements in both the soil and leaves and they can be put to good use in a fertilisation programme.

Band placing should be properly done at least 5cm away (left or right) and 5cm below the seed to prevent 'fertiliser burn'. With the broadcasting of these elements, conventional tilling will provide 'speedier' results than under no-till systems (especially with P that moves very little in soil).

The time of application is still a contentious discussion point. However, since soya reacts well to residual fertilisation it should be irrelevant, with the provision that optimal levels of P and K are maintained in the soil.

The practice of the past which is often still followed of better fertilising the preceding crop (for example maize) and thereby making provision for 'transfer fertilisers', should be treated with caution for soya, since maize yields have increased tremendously in recent times and therefore much more nutrients are removed by the maize harvest itself.

Leaf supplements

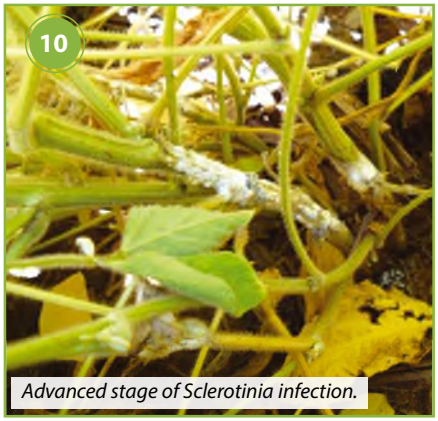
Soya bean plants cannot be nourished with leaf applications of the three primary (N, P and K) and three secondary elements (Ca, Mg and S). These elements should preferably be applied in the soil. Under excessively low (<5,5) and high (>7,5) pH conditions, plants will respectively absorb Mo and Mn, Cu, Fe, Zn and B with difficulty through the roots, and it is desirable to practice supplementation as a result of soil and especially leaf analysis.

There are good critical values for all the macro- and micro-elements in both the soil and leaves and they can be put to good use in a fertilisation programme.

Disease and pest control

Nematodes and *Sclerotinia* (*Photos 9* and *10*) are responsible for great losses in large parts of the country, and unfortunately there are still few resistant cultivars against nematodes and none that control *Sclerotinia*.

Roots infected with root knot nematode.



Advanced stage of Sclerotinia infection.

Sandy soils are indeed more prone to nematodes, but they also occur in heavier soils. Root knot nematode is the main species in South Africa and although there already exist cultivar varieties offering some degree of resistance, most cultivars are highly susceptible. In other countries such as Argentina there are already available cultivars that are resistant and some of these could soon also become available in South Africa. They would have to be tested first to determine resistance to all the nematode species in the country. Good nodulation and healthy plants often decrease the nematode problem.

Sclerotinia is a disease that develops under cool conditions (night temperatures of below 15°C for ten consecutive nights) and wet or damp conditions under the foliage of soya beans. Sclerotia (the fruit bodies of *Sclerotinia*) will 'germinate' in above-mentioned conditions to form so-called 'apotecia' (mushroom-like structures) that then produce and release spores through lesions on the soya such as where flowers sprout, thereby infecting the plants. From germination up to contamination takes roughly 20 to 30 days. All cultivars in South Africa are susceptible to the disease.

Sclerotinia is combatted with great success on the Highveld by making use of quick cultivars with a particular way of growth. Before the foliage closes and thus creates favourable conditions for the disease to develop, the cultivar would have already flowered and would already be in the pod-filling stage that then significantly reduces the risk of infection. These quick-acting cultivars are not readily recommended for warmer irrigation regions, since the yield potential thereof are lower than in cooler regions.

Night irrigation, which is commonly practised and with good reason in the warm irrigation regions, contributes towards the fact that night temperatures can drop below 15°C under the foliage, and *Sclerotinia* contamination can therefore even occur in these areas.

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