



In order to produce soybeans of a good quality, extra potassium fertiliser added to soil that was adequately analysed will be to the benefit of every farmer.

A few ideas about the FERTILISATION OF SOYBEANS

The growing interest in the maximum production of soybeans countrywide justifies the new view of the fertilisation of this crop. There are many conflicting statements about the fertilisation of soybeans.

In many instances fertilisation is alleged not to have a positive influence on the yield of soybeans. This can be seen in the band placement of fertiliser in particular. Here are the most probable reasons for a poor reaction to fertilisation:

- The phosphate and potassium content of the soil is higher than the critical needs level.
- A drought period in the growing season had a greater influence on production than fertilisation.
- Planting conditions (soil temperature and moisture) were ideal.
- The fertilisation was insufficient or imbalanced.

This article focuses on the most recent information regarding the fertilisation of soybeans and provides information on the nutrients that will provide the most probable improvement in the yield. However,

it does not guarantee that the yield will improve. In a good growing season like the past one, it will probably contribute to an improvement in the yield.

Soybeans have a greater need for phosphate and potassium than maize. One ton of soybeans extracts up to 9 kg of P and 40 kg of K per hectare. If these needs are not addressed, the yield can be affected negatively. The yield of the follow-up crops can also be harmed and in the long term it could have a disastrous effect. To rectify these problems afterwards can become very expensive.

Soybeans use a lot of nitrogen. Every ton of soybeans that is harvested extracts 50 kg to 60 kg of nitrogen per hectare from the system. All the nitrogen must be extracted from the soil by the roots. By using nitrogen-fixing Rhizobia bacteria this constant need can be met very cheaply.

This beneficial association that soybeans have with Rhizobia bacteria must be managed correctly. If nitrogen is available in the soil, soybean roots will rather extract that and will not allow the Rhizobia bacteria to form nodules on the roots. This can lead

to the dying off of the Rhizobia bacteria, or to the late forming of nodules, which could lead to insufficient nitrogen fixation.

If it were suspected that the grafting process was faulty and soybeans are yellow and poorly developed in December or January, poor noduling must be suspected of being the culprit. The best way to identify this problem is to dig up the affected plants very carefully and rinse them with water. Count the healthy nodules on the roots. Healthy nodules are larger than 2 mm in diameter and are pink to red when cut. If fewer than seven healthy nodules per plant are found, a nitrogen deficiency can be expected.

Supplementary administration of 60 kg to 70 kg of nitrogen per hectare will address the deficiencies when it is administered timeously. The ideal time for administration is when the first blossoms are seen on 50% of the plant (R1), and not later than when the top node of the plant starts flowering on 50% of the plants (R2).

The ideal will be to apply the nitrogen on the soil, but this is very difficult as the leaf canopy



would already have covered the rows. Broadcast application of granular fertiliser can be done successfully if the plants are dry and the granules can roll down the leaves.

Before any fertiliser can be applied, the pH of the soil must be corrected. A soil pH (KCl) of between 5 and 6 is ideal. Most chemical and biological processes function optimally at this pH. Together with an optimal pH, calcium is vital to keep the soil healthy. Not only the nitrogen-binding bacteria will benefit, but all the other organisms in the soil as well.

The application of lime to maintain the levels must be done with the aid of analyses and expert advice. If acid soil that had maize as the previous crop is limed, the effect of herbicides that were settled and could become dislocated must be kept in mind. In most cases band placement of nutrients in soil with more than 15% clay has no yield benefit. Broadcast application of phosphate and potassium before the making of a seedbed produces a better reaction.

The greatest need of soybeans for nutrients is in the second half of the growing season. The broadcast application of nutrients is better utilised by the widely spread fine roots in the top 20 cm of the soil. However, in sandy soil with a low clay content, soybeans will react well to band placement of fertiliser. The fertiliser must be placed 5 cm from and below the seeds to restrict the risk of burning the

Table 1: Guideline for P fertilisation of soybeans.

Soil P	P recommendation for yield potential (ton/ha)				
(Bray 1)	1	2	3	4	>4
dpm	kg/ha				
5	20	40	60	80	100
10	17	31	45	59	73
15	15	25	35	45	55
20	13	21	31	40	49
25	11	19	28	36	45
30	10	18	26	34	42

Fertilisation manual, FSSA 1998

Table 2: Guideline for K fertilisation of soybeans.

Soil K	Application of K for yield potential (ton/ha)				
	1	2	3	4	>4
dpm	kg/ha				
20	20	40	60	80	100
40	16	31	47	60	75
60	13	25	39	52	65
80	11	22	34	44	54
100	10	20	31	40	51
120	9	19	30	40	51
> 120	5	15	30	40	51

Fertilisation manual, FSSA 1998

seedling as well as the Rhizobia bacteria. The roots of the small soybean seedling are very sensitive and are easily burnt by the high concentrations of salts in fertiliser when it is placed too near the seeds.

The amount of fertiliser must be determined according to a soil analysis and the yield target for each field (**Table 1 and Table 2**). Phosphate and potassium must be addressed to get this to sufficient levels.

Phosphate is essential for early root development and for transferring energy in the plant, while potassium is essential for forming nitrogen-fixing nodules together with Rhizobia bacteria. Potassium is also essential to the nitrogen-binding process, as well as for the transport of nutrients and proteins through the plant.

Soybean plants that have sufficient potassium available can handle dry periods better than those that have some deficiencies. Small amounts of nitrogen (10 kg - 25 kg N/ha) can be beneficial for early growth to ensure stronger plants, but in most cases this will not increase the yield. These low nitrogen levels will not harm the development of nitrogen-fixing Rhizobia bacteria. One often reads that South African soybean crops have a lower protein content than those of other countries. The regular periods of drought that we experience in the second half of the growing season are the main reason for this. A lot of research also shows that minor potassium deficiencies have a greater influence on the protein content of the soybeans than the yield.

A lot of South Africa's soil has a relatively poor potassium content, or it may not always be available to the plant. In order to produce soybeans of a good quality, extra potassium fertiliser added to soil that was sufficiently analysed will be to the benefit of every farmer.

Soybeans have a great need for sulphur. In soil known to be deficient in sulphur, or to have a low clay content, sulphur can be used for fertiliser. Up to 15 kg of S/ha can be administered with safety. Magnesium deficiency is another element that has a great influence on yield. In soil with a high pH showing deficiencies, up to 2,5 kg of Mg/ha can be added to fertilisers.

Molybdenum is essential for the fixation of nitrogen by nodule bacteria and the transportation of proteins in the plant. In soil with a pH lower than 5, molybdenum is not available for uptake and must be added. Low quantities of molybdenum (80 g/ha to 150 g/ha) as seed treatment or added to the plant furrow will address the problem.

As was mentioned at the beginning of the article, in many instances soybeans do not react to added fertiliser. That is not enough reason not to fertilise soybeans. The large quantities of nutrients that soybeans remove must be addressed in a sustainable farming system. This can easily be done during seedbed preparation, or with the whole fertilisation programme of the previous or follow-up crop. In fields with a relatively low nutritional status it is better to fertilise annually compared to fields with a good nutritional status that could be fertilised every two years with crop rotation.

If you keep the soil healthy, the soil will care for your soybeans and produce a good yield.

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