FERTILIZING SWEET POTATO ON MINERAL SOILS IN THE HIGHLANDS

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INTRODUCTION

Very many people are interested in increasing sweet potato yields. One of the ways in which this can be done is by proper use of fertilizers, either organic or inorganic. This article talks about the use of inorganic fertilizers, such as urea, superphosphate or muriate of potash. Also, we will be talking about mineral soils rather than peat soils, so it is important to know what the differences are between these two types of soil.

THE DIFFERENCE BETWEEN A MINERAL SOIL AND A PEAT SOIL

These are not really very accurate ways of describing a soil, but they are useful to help us understand how to fertilize sweet potato for increased yields.

Mineral soils are by far the most common, and there are many different kinds of them. They are the kinds of soils we find just about everywhere - on hillsides, in valleys, along rivers.

Peat soils are usually found in swampy areas (e.g. the Wahgi swamp in the Western Highlands, the Kamanakira swamp in the Eastern Highlands), and many small poorly drained gullies. Peat soils have a very high organic (from plants or animals) matter content and usually a lot of plant material down the profile.

So it can be seen that for the Highlands as a whole, mineral soils cover vast areas while peat (or organic) soils cover much smaller areas.

A GENERAL RECOMMENDATION FOR MINERAL SOILS

A recommendation is given here for fertilizing sweet potato grown on mineral soils in the Highlands. It is a result of

Mineral soils are found everywhere, just like this typical highlands area of hills and valleys. Peat soils, on the other hand, are found in swamps.

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three experiments on three different mineral soils. They all gave the same trends in their results.

It is true that it is not always safe to say that the results can be used for all situations on mineral soils. However, until more detailed work can be carried out at more local areas in future years, the recommendation should still prove very useful generally.

We know that in many countries, for example Taiwan, Japan, India, U.S.A., New Zealand, Egypt and in the lowlands of Papua New Guinea, most responses to fertilizing sweet potato are to nitrogen and potassium. This in fact is what happened in the three experiments discussed here. There were good responses to applying nitrogen and potassium, but no response to applying phosphorus.

THE RESULTS OF THREE EXPERIMENTS

Three very different mineral soils were chosen for the experiments. The three soils were a meadow soil at Aiyura, a soil with some ironstone gravel in the profile, also at Aiyura, and a colluvial soil near the Asaro river near Goroka. Soils like these are widespread in the Highlands.

The fertilizers used were urea (as a source of nitrogen), superphosphate (as a source of phosphorus) and muriate of potash (as a source of potassium). The trends were the same in all experiments, with a large response to urea, no response to superphosphate, and a large response to muriate of potash. Tables 1, 2 and 3 (below) show the results.

TABLE 1. RESPONSE TO UREA (SOURCE OF NITROGEN)

Urea rate (kg/ha)	Nil	90	180
Yield of marketable tubers (kg/ha)	23 600	29 500	28 600

TABLE 2. RESPONSE TO SUPERPHOSPHATE (SOURCE OF PHOSPHORUS)

Superphosphate rate (kg/ha)	Nil	280	560
Yield of marketable tubers (kg/ha)	27 000	27 300	27 400

TABLE 3. RESPONSE TO MURIATE OF POTASH (SOURCE OF POTASSIUM)

Muriate rate (kg/ha)	Nil	160	320	640	1280
Yield of marketable tubers (kg/ha)	21 800	27 400	28 600	27 400	31 100

SOME IMPORTANT POINTS

From these results, there are a few practical things to notice.

Nitrogen

Table 1 shows that there is a big increase in yield if urea is applied at 90 kg/ha - about 5900 kg/ha of marketable tubers. If urea is applied at 180 kg/ha, there is still a big increase in yield over nil, but in fact it is slightly less than the increase with 90 kg/ha. So the thing to do with urea is to apply 90 kg/ha and no more.

Phosphorus

The figures in Table 2 show a small increase in yield from applying superphosphate, but only 300 to 400 kg/ha approx. This increase in yield is not a big enough difference to be significant. So there is no real need to apply superphosphate to increase sweet potato yields on these soils.

Potassium

When muriate of potash was applied (Table 3) there was a big increase in yield at the first rate of 160 kg/ha - about 5600 kg/ha of marketable tubers. The higher rates also gave big increases in yield over nil, especially for the 1280 kg/ha rate. However, 1280 kg/ha of muriate of potash is a very high rate of application and therefore very costly. Overall in this case it is better just to stay at 160 kg/ha of muriate of potash to give the best economic response.

Conclusion

Applying nitrogen (as urea) and potassium (as muriate of potash) have both increased yields, while applying phosphorus (as superphosphate) has not.

A LOOK AT PROFITS

Let us examine the profits that a grower could expect when he applies urea and muriate of potash to sweet potato.

If 90 kg/ha of urea and 160 kg/ha of muriate of potash are applied what returns are we likely to get?

The fertilizers themselves are very costly, and there are extra costs of transporting to the farm and costs of application in the field. Table 4 cannot be accurate for all farms, but it does give some idea of what to expect.

A grower could expect therefore very good extra returns from applying urea or muriate of potash to his sweet potato, whether he is growing it for subsistence or for cash. It is around about K500 per ha extra for either urea or muriate of potash. If both are used, the extra returns could go as high as K1000 per ha.

HOW TO APPLY THE FERTILIZER

When applying these two fertilizers, it is a good idea to mix them together, so they only have to be applied once. However, it is also a good idea to mix them at the same time they are being used in the field, and not before. This is because when they are mixed together and left in a bag in the open air they may get spoiled.

It is hard to get accurate measurements for mixing and applying fertilizer in the farm situation, so let us use a way which is not quite exact, but still works well. All that is needed is a bucket, a fish tin (425 g or 15 oz) and an empty matchbox. Put a fish tin of urea in the bucket, and two fish tins of

TABLE 4. RETURNS FROM APPLYING UREA AT 90 KG/HA AND MURIATE OF POTASH AT 160 KG/HA (ALL FIGURES ARE PER HECTARE)

		Urea	Muriate of potash
1.	Increase in yield of marketable tubers, approx. (From Tables 1 and 3)	5900 kg	5600 kg
2.	Value at 10t/kg	K590	K560
3.	Purchase price of fertilizer at Goroka at 35t/kg for urea and 36t/kg for muriate of potash *	K32	K58
4.	Cost of transport to farm gate, approx.	K2	K2
5.	Application costs	K20	K20
6.	Total costs (line 3 plus line 4 plus line 5)	K54	K80
7.	Net return (line 2 less line 6)	K536	K480

* Based on a price of K17.50/bag of urea and K18.00/bag of muriate of potash.

potash. This can be done a number of times. Then mix the contents of the bucket by hand.

Highlanders are very good at making neat, orderly gardens so it should be no trouble to mark out the garden in a good way so that the fertilizer can be applied accurately. Sometimes sweet potato is planted in beds, and sometimes in mounds.

If mounds are used, they can be marked out on the ground first. The man in the picture opposite is making mounds which are 1 x 1.25 m apart. The markings on the ground can be seen behind him. After the markings are made and before the mounds are made, the fertilizer mixture is spread on the flat ground, one matchboxful for each mound.

You will notice that the fertilizer rate is 90 kg/ha of urea

If mounds are used, they are marked out on the ground. The fertilizer is then applied, and the mounds are then made on top of the fertilizer.

and 160 kg/ha of muriate of potash. This gives 250 kg/ha of the mixture. For mounds 1 x 1.25 m apart, this is only about 1 matchboxful per mound. This is not very much.

If your mounds are not 1 x 1.25 m apart, but they are still about the same size as shown in the picture, then it will still be alright.

The man in the picture on page 74 has already put the fertilizer on the ground. and now he is making the mounds, covering up the fertilizer. This means it will be about 25 - 30 cm below the top of the mound. Although you can just put the fertilizer on top of the mound, it is not really a good idea, because it will not do its job so well. It is far better to have it underneath where the roots of the sweet potato will find it quickly.

If you are planting your sweet potato in beds, it is a little harder to put in the right amount of fertilizer. In the picture on this page, the man has marked out his beds 1.25 m apart. He has already put the fertilizer on the flat ground, and now he is covering it up.

If ridges are used, they are marked out first, the fertilizer is then put on the ground, and the ridges are made on top of the fertilizer. The ridges can also be made by tractor.

The way to put the fertilizer on is one fish tin per 10 m of bed. The fertilizer is spread by hand down the middle of where the bed will be, in a band about 0.5 m wide. When this is done, the beds can be made. The beds do not have to be exactly 1.25 m apart, but as long as they are about the same as in the picture, it is alright.

SOME AREAS ARE DIFFERENT

The mounds and ridges shown in the two pictures are typical of some areas of the Highlands only. For example in other areas, people use squares or very large mounds to grow their sweet potato. In such cases, if you want to work out the fertilizer rates per square or per mound, all you need to do is to work out the area of a square or a mound and then find out how many mounds there are in a hectare, then calculate the amount of fertilizer per square or mound.

For example, a large mound is found to take up an area of 16 square metres. There are 10 000 square metres in a hectare, so there are 10 000 ÷ 16 = 625 mounds/ha.

Our fertilizer mix is applied at 250 kg/ha, that is 250 000 g/ha. So the amount of fertilizer per mound is 250 000 ÷ 625 = 400 g.

To help the farmer, make a small container (like a cut off tin) which holds about 400 g when full, and that will be his measure.

USING DIFFERENT FERTILIZERS

In this bulletin we have used urea and muriate of potash. Other fertilizers which can be used are sulphate of ammonia (instead of urea) and sulphate of potash (instead of muriate of potash). If sulphate of ammonia is used, just double the urea rate. If sulphate of potash is used, just use about 20% more than muriate.

FURTHER INFORMATION

The Agronomist-in-Charge at Aiyura or any of his staff working on food crops can help with additional information if needed. The address is:

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