Crop Nutrition – Fertiliser and Manure Use

Guidance for allotment holders on soil derived from **chalky boulder clay** as occurs at St Ives, Cambridgeshire and across much of East Anglia and into parts of Leicestershire and Northamptonshire.

The most important plant nutrients on this soil type -

Major nutrients

- Nitrogen (needed by everything except peas and broad beans)
- Phosphorus (often do need to add on heavy soil)
- Potassium (not normally needed on heavy soil)
- Magnesium (not needed on heavy soil)
- Sulphur (not needed on heavy soil)

Trace elements

- Manganese (sometimes need to spray crop foliage on any soil type)

Use of organic manures (e.g. cattle manure and compost)

Note: To a crop it doesn't matter if it gets its nutrients from a bag or the back end of a pig – it's the same nutrient.

For some manures, the time of year when spread affects the supply of nitrogen to the crop because autumn application loses some nitrogen by downward leaching in drainage water over winter. So provided you can work the soil it is preferable to spread and dig in manures in spring because this gives the best nitrogen release timing advantage. Additionally, it is best to dig in the manure on the same day as spreading since this minimises the loss of valuable nitrogen to atmosphere as ammonia gas from the soil surface.

In the following table, "Old" manure is more than 3 months old and "Fresh" manure is younger than this. Layer manure comes from poultry laying hens and broiler manure comes from poultry broiler chickens.

Typical amounts of useful nutrients per tonne (kg per tonne)

Manure type	Autumn spread Nitrogen	Spring spread Nitrogen	Spread any time	
			Phosphate	Potash
Cattle, old	0.6	0.6	3.2	8.0
Cattle, fresh	0.6	0.9	3.2	8.0
Pig, old	1.0	1.0	6.0	8.0
Pig, fresh	1.0	1.3	6.0	8.0
Layer	6.5	10	14	9.5
Broiler	9.0	12	25	18
Horse	0.5	0.5	5.0	6.0
Compost	Nil	Nil	3.0	5.5

All organic manures also contain magnesium and sulphur.

At what point in the rotation is manure best used?

Preferably 2 years in 5

Year 1	Year 2	Year 3	Year 4	Year 5
Apply manure		**Apply manure**		
Potatoes	Carrots Parsnips Leeks Beetroot Tomatoes	Cabbage Brussels Cauliflower Broccoli Turnips/swedes	Peas Broad beans Runner beans	Sweetcorn Onions Courgettes Lettuce Others

Otherwise, 1 year in 4

Year 1	Year 2	Year 3	Year 4
Apply manure			
Potatoes	Cabbage Brussels Cauliflower Broccoli Turnips/Swedes	Peas Broad beans Runner beans	Carrots Parsnips Leeks Beetroot Tomatoes

Preferred rate of application of manures

Manure type	kg/square metre	lbs/square yard
Cattle, old	4	7.5
Cattle, fresh	4	7.5
Pig, old	4	7.5
Pig, fresh	4	7.5
Layer	2	3.5
Broiler	2	3.5
Horse	4	7.5
Compost	5	9

When manures are used in the rotation on chalky boulder clay the only additional major nutrient fertiliser normally needed is nitrogen. However, phosphorus fertiliser may also be needed where cattle manure or compost has been spread. ***Mix manures well into the top 15 to 20 cm (6 to 8 inches), especially poultry manures; else the nitrogen can scorch sensitive seedlings.***

Suitable inorganic fertilisers

Nitrogen (N)
Ammonium sulphate (sulphate of ammonia), 21% nitrogen (N).
Nitrochalk (calcium ammonium nitrate), 26% nitrogen.
Urea, 46% nitrogen
Commercial farmers use either ammonium nitrate (34.5% nitrogen) or urea.

Phosphorus (P) or Phosphate (P_2O_5)
Superphosphate. Normally only available as single superphosphate which is 19% phosphate (P_2O_5) although farmers always use triple superphosphate which is 46% phosphate.

Potassium (K) or Potash (K_2O)
Potassium sulphate (sulphate of potash), 48% potash (K_2O).
Farmers use muriate of potash (potassium chloride) which is 60% potash.

Many other fertilisers are effective but less suitable because they are significantly more expensive or have much lower nutrient content or they release nutrients too slowly or have two or three of these disadvantages. Examples are Nitrofrorm, Magphos (formerly Enmag), Osmocote, Vitax Q4, Phostrogen, mono ammonium phosphate, potassium phosphate, potassium nitrate and slow release fertiliser. Similarly Growmore is too expensive for what it is; a dilute 7% nitrogen, 7% phosphate and 7% potash fertiliser. Furthermore, calcium nitrate (15% nitrogen) is too expensive - which should not be confused with Nitrochalk (calcium ammonium nitrate) which is recommended above.

Organic fertilisers are generally less suitable because they are usually much lower in nutrient content, expensive and less predictable in their rate of nutrient release. Examples are blood, fish and bone meal, hoof and horn, bone meal, dried blood, rock potash and rock phosphate. Seaweed, either as a liquid, powder or in crushed form contains little that is of benefit to crops on chalky boulder clay.

Note: *All fertiliser rates given below in gms/sq metre and in ozs/sq yard are approximate so there is no need to be fussy – use your best guess at rates. Furthermore, if anything, the suggested rates are a little bit on the high side.*

Nitrogen fertiliser use – 1

1 Where manures have been used for this year's crop.

a) Where manures **have** (**YES**) been used this year for potatoes or brassicas, apply the following amounts when **ammonium sulphate** is used.

Manure	When	Potatoes		Brassicas	
		gms/sq m	*ozs sq yd*	*gms/sq m*	*ozs sq yd*
Cattle, old	Any time	90	2.5	140	4
Cattle, fresh	Autumn	90	2.5	140	4
Cattle, fresh	Spring	70	2	120	3.5
Pig, old	Any time	70	2	120	3.5
Pig, fresh	Autumn	70	2	120	3.5
Pig, fresh	Spring	55	1.5	105	3
Layer	Autumn	35	1	85	2.5
Layer	Spring	Nil	Nil	50	1.5
Broiler	Autumn	20	0.5	70	2
Broiler	Spring	Nil	Nil	35	1
Horse	Any time	90	2.5	140	4
Compost	Any time	100	3	150	4.25

For turnips and swedes use only half the brassicas recommended rate.
For potatoes, fork in half the nitrogen into the trench before planting and the remainder top-dressed in mid May to mid June and lightly watered in.
For brassicas, apply half at 2 to 4 weeks after planting/drilling and the remainder during the growing season but always water in lightly.

b) Where manures **have** (**YES**) been used this year for potatoes or brassicas, apply the following amounts where **nitrochalk** is used.

Manure	When	Potatoes		Brassicas	
		gms/sq m	*ozs sq yd*	*gms/sq m*	*ozs sq yd*
Cattle, old	Any time	70	2	110	3
Cattle, fresh	Autumn	70	2	110	3
Cattle, fresh	Spring	55	1.5	100	2.75
Pig, old	Any time	55	1.5	100	2.75
Pig, fresh	Autumn	55	1.5	100	2.75
Pig, fresh	Spring	45	1.25	90	2.5
Layer	Autumn	30	0.75	65	2
Layer	Spring	Nil	Nil	40	1.25
Broiler	Autumn	15	0.4	55	1.5
Broiler	Spring	Nil	Nil	30	0.75
Horse	Any time	70	2	110	3
Compost	Any time	80	2.25	120	3.5

For turnips and swedes use only half the brassicas recommended rate.
For potatoes, fork in half the nitrogen into the trench before planting and the remainder top-dressed in mid May to mid June and lightly watered in.
For brassicas, apply half at 2 to 4 weeks after planting/drilling and the remainder during the growing season but always water in lightly

c) Where manures **have** (**YES**) been used this year for potatoes or brassicas, apply the following amounts where **urea** is used.

Manure	**When**	**Potatoes**		**Brassicas**	
		gms/sq m	***ozs sq yd***	***gms/sq m***	***ozs sq yd***
Cattle, old	Any time	35	1	55	1.5
Cattle, fresh	Autumn	35	1	55	1.5
Cattle, fresh	Spring	30	0.75	50	1.4
Pig, old	Any time	30	0.75	50	1.4
Pig, fresh	Autumn	30	0.75	50	1.4
Pig, fresh	Spring	20	0.5	45	1.25
Layer	Autumn	15	0.4	35	1
Layer	Spring	Nil	Nil	20	0.5
Broiler	Autumn	10	0.25	30	0.75
Broiler	Spring	Nil	Nil	15	0.4
Horse	Any time	35	1	55	1.5
Compost	Any time	40	1.25	60	1.75

For turnips and swedes use only half the brassicas recommended rate.
For potatoes, fork in half the nitrogen into the trench before planting and the remainder top-dressed in mid May to mid June and lightly watered in.
For brassicas, apply half at 2 to 4 weeks after planting/drilling and the remainder during the growing season but always water in lightly

Nitrogen fertiliser use – 2

2 Where manures have NOT (NOT) been used for this year's crop.

Fertiliser	Units	High vigour crops	Medium vigour crops	Low vigour crops
		Brussels sprouts Cabbage Cauliflower Calabrese Broccoli Beetroot Tomatoes Peppers	Potatoes Dwarf beans Runner beans Lettuce Sweetcorn Onions Leeks Parsnips Swedes Turnips Spinach Chrysanthemums	Celery Radish Courgette Carrots
Ammonium sulphate	gms/sq m	150	100	70
Ammonium sulphate	ozs sq yd	4.25	3	2
Nitrochalk	gms/sq m	120	80	55
Nitrochalk	ozs sq yd	3.5	2.25	1.5
Urea	gms/sq m	60	40	30
Urea	ozs sq yd	1.75	1.2	0.8

Peas and broad beans **do not** require any nitrogen fertiliser.
For low vigour crops all the nitrogen can be applied in one go, usually mixed into the seedbed. For medium vigour crops split the nitrogen into 2 dressings and for high vigour crops split the nitrogen into 2 or 3 dressings.

Phosphorus fertiliser use – 1

1 Where manures have (YES) been used in the rotation
Heavy soils (clay soils) tend to be on the low side in phosphorous content.

Where cattle manure (old or fresh) or compost have been used in the rotation, superphosphate (single superphosphate) should be used ***once every 4 or 5 years*** at 100 gms/sq metre (2.75 ozs/sq yard). If triple superphosphate is available from a farmer this should be used at 40 gms/sq metre (1.25 ozs/sq yard). Where any other manure type has been used in the rotation there is no need to add phosphorus fertiliser because all other manures supply more than enough phosphorus.

The superphosphate should preferably be applied to the soil and worked into the **potato seedbed** because potatoes are the most responsive crop to phosphorus.

Phosphorus fertiliser use – 2

2 Where manures have NOT (NOT) been used in the rotation
Superphosphate (single superphosphate) should be used ***once every 2 or 3 years*** at 100 gms/sq metre (2.75 ozs/sq yard). If triple superphosphate is available from a farmer this should be used at 40 gms/sq metre (1.25 ozs/sq yard). One of the superphosphate applications should preferably be applied to the soil and worked into the **potato seedbed**.

Potassium fertiliser use

Chalky boulder clay (and many other clay soils) always has a large content of potassium. If any type of manure is used in the rotation, even if only once every 5 or 6 years, there is no need to add more potassium. However, if manures are **NOT** used in the rotation it would be prudent to spread potassium ***sulphate once every 4 or 5 years*** at 35 gms/sq metre (1 oz/sq yard). Again the potassium sulphate should preferably be applied to the soil and worked into the **potato seedbed** because potatoes remove more potassium than any other crop.

Trace elements

The only trace element deficiency that might occur is manganese deficiency, which is common every year in a wide range of commercial crops in the UK across many soil types. Practically any crop can be affected but beetroot, parsnips, lettuce, peas, carrots and potatoes are some of the more sensitive.

Treating the soil is not effective so susceptible crops must be treated with a spray to the foliage each year. Manganese sulphate should be used as a foliar spray at 20 gms per litre of water (3.2 ozs/gallon). Sometimes two separate sprays are needed about a month apart for good control.

The packet will suggest a far weaker spray than this but farmers use around 36 gms per litre so 20 gms per litre is entirely safe. To make it stick to the foliage a wetter (surfactant) should be used and shaken in with the water– this is particularly important on brassicas crops since these have waxy leaves. If a proprietary wetter is not available an alternative is to use a few drops of washing up liquid per litre of water and shaken in but take care not to use too much washing up liquid else it can scorch the crop. Spray early morning or in the evening to minimise scorch risk even when using a proprietary wetter.

Liquid feeds

A top-up liquid feed containing nitrogen can be very useful for vigorous crops such as Brussels sprouts and cauliflowers – apply 2 or 3 times in the growing season to the base of the stem. Additionally it can be lightly watered over the top of any crop type if you think you may not have given enough solid nitrogen fertiliser. A liquid feed of nitrogen to a crop is like a cup of tea to a human – it bucks them up.

Beware – it is entirely safe to water liquid feeds onto foliage but they should quickly be lightly washed off into the soil with plain water to avoid risk of scorch. This is very important on sunny days.

An appropriate nitrogen liquid feed can be made up by dissolving 22 gms of ammonium sulphate in 10 litres (a bucketful) of water (0.7 oz of ammonium sulphate in 2 gallons of water). Alternatively use 18 gms of nitrochalk in 10 litres (a bucketful) of water (0.6 oz of nitrochalk in 2 gallons of water). Nitrochalk produces a cloudy solution but this is harmless. As a third alternative use 10 gms of urea in 10 litres (a bucketful) of water (0.35 oz of urea in 2 gallons of water).

Tomatoes produce sweeter tasting fruit when fed with a liquid feed containing both nitrogen and potassium. Water the base of the stem every 10 to 14 days throughout the summer using a liquid feed containing 22 gms of ammonium sulphate plus 11 gms of potassium sulphate in 10 litres (a bucketful) of water (0.7 oz of ammonium sulphate plus 0.35 oz of potassium sulphate in 2 gallons of water). Alternatively use 18 gms of nitrochalk plus 11 gms of potassium sulphate in 10 litres (a bucketful) of water (0.6 oz of nitrochalk plus 0.35 oz of potassium sulphate in 2 gallons of water). As a third alternative use 10 gms of urea plus 11 gms of potassium sulphate in 10 litres (a bucketful) of water (0.35 oz of urea plus 0.35 oz of potassium sulphate in 2 gallons of water). ***The intermediate waterings should be with plain water – either from rain or a tap.***

Chrysanthemums and cucumbers also benefit from occasional feeding with a liquid feed containing both nitrogen and potassium.

To improve soil drainage on heavy soil

Apart from putting in field drains at depth to the entire site with gravel above the drains to act as permeable fill, this is not easy to achieve. The second best action is to thoroughly mix compost into the top 25 to 30 cm (10 to 12 inches) of soil at 7 kg per sq metre (13 lbs per sq yard) – this is about 10 cm (4 inches) depth of compost on the surface at spreading. Clay breakers such as gypsum (calcium sulphate) or modern proprietary soil conditioners or dolomite lime are very expensive in practice because of the large amount needed to do any useful good on chalky boulder clay soil.

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