



Green Manuring Crops

INCORPORATION OF GREEN MANURE

With all green manuring crops it is important to make sure that the plant is incorporated when it is in its most succulent state; in this way the amount of carbon within the plant structure is very low. Decomposition needs soil nitrogen to break down carbon, the woodier the plant the greater the carbon content and hence greater quantities of soil nitrogen are required to break it down. It should also be borne in mind that the main crop should not be sown too soon after the green manure has been turned under, since the initial stage of decomposition is very unfavourable for germination and the growth of young plants. Therefore, the incorporation and subsequent decay of the green manure or cover crop should occur at the time it will best serve as fertiliser for the crop it is to benefit.

Green Manuring can bring many advantages to the farmer by adding organic matter to the soil, increasing biological activity, improving soil structure, reducing erosion, increasing the supply of nutrients available to plants (particularly by adding nitrogen to the system by fixation), reducing leaching, weed suppression and so on. There are some disadvantages and whilst these are few they should also be noted - lost opportunities for cash cropping, exacerbated pest and disease problems (green bridge effect), and the potential for green manures to become weeds in their own right. These problems can be overcome with thought and measured usage, and the benefits to future crops cannot be dismissed lightly.

Green manures not only improve soil status, composition and nutrient balance but provide a basis for a more environmentally friendly approach to modern farming. We need to focus our minds on the twin problems of high artificial fertiliser prices and the soil's need for basic nutrients with these being available in a more sustainable form.

A wide range of plant species can be used as green manures. Different crops bring different benefits and the final choice is influenced by many considerations. If the most is to be made of green manuring crops, it is important that they are carefully integrated into the crop rotation and proper attention paid to their husbandry.

Green manures can be categorised as spring sown for summer usage and autumn sown for over-winter usage, intercropping and longer term fertility improvement.

Nitrogen (N) in legumes comes from uptake of soil N and the fixation of N from the atmosphere. The amount of N fixed by different legumes is determined by the inherent capacity of the crop/rhizobium symbiosis to fix N, modified by the crop's growing conditions (e.g. soil, climate, disease), crop management and length of time for which the crop is grown. Consequently, the influence of all these factors means that a wide range of values has been reported by different researchers. The presence of soil mineral N is generally thought to reduce fixation capacity. Factors that will increase the soil mineral N pool include manure application, cutting and mulching, and grazing. Fixation tends to decrease with legume age, mainly because the amount of soil N tends to increase.

Where growth of legumes is affected by nutrient deficiency (or acidity) the potential for soil N build up is reduced. Phosphorus, Sulphur and some trace elements (e.g. Molybdenum) are particularly important. Where there are large off-takes of soil nutrients as in silage crops both Phosphorus and Potash supplies need to be adequate for satisfactory legume growth. These should be replaced as they are essential to the legume to enable it to maximise the fixing of nitrogen.

FOR SPRING SOWING AND SUMMER INCORPORATION

Spring sown, summer crops are usually annual crops that as a rule do not tolerate frost. They are quick growing and will suppress weeds by light deprivation as well as providing organic material to improve soil structure and organic status. As they are usually fleshy crops and do not contain high proportions of carbon when incorporated into the soil, they do not substantially reduce stocks of soil nitrogen in the breaking down of the plant structure.

AUTUMN SOWING & SPRING INCORPORATION

Autumn sown crops which go through the winter will scavenge nitrogen from soils thus preventing "leaching" and can be incorporated in the following spring, or can provide a source of forage, prior to incorporation. They also help to control erosion especially on late harvested maize stubbles. Certain species can be utilised to provide a nitrogen fixer which is then readily available to a spring sown crop.

LONGER TERM CROPS

Grass and clover leys for long term fertility building must by their nature form part of the rotation. The increased duration of the sward ensures that the grass element provides a very strong root system valuable for soil aeration, whilst the legumes with their deeper root system will improve water filtration through the soil structure whilst also providing increased soil nitrogen.

Crop	Pack size	Av sowing rate kg/acre	Treatment type	Sowing dates	Incorporation period	Root type/ depth	Soil type	Useful information and growing tips
Short Term Crops Spring/Summer Sowing & Summer/Autumn Incorporation								
White Mustard	5kg & 25kg	5 - 7	Untreated, Cruiser OSR & Organic	Spring - Early Autumn	8 weeks after sowing	Fibrous root system	All types, best on light, sandy soils	Fast growing and good weed suppressor. Has biofumigation properties but not to same extent as brown mustard. Produces large quantities of biomass. Excellent scavenger of nitrogen. Requires fine seedbed. Susceptible to club root. Plough in before flowering to prevent self-seeding.
Brown Mustard	5kg	2 - 3	Untreated	Spring - Autumn	Autumn - Spring	Tap root	All types, prefers moist ground.	As white mustard, but contains high levels of glucosinolate which create biofumigation properties to reduce wireworm infestation. To maximise this benefit, crop must be finely chopped at flowering and thoroughly incorporated into moist soil. Brown mustard is winter hardy so is excellent for reducing soil erosion, water run-off and fertiliser leaching when grown after maize, potatoes & sugar beet.
Phacelia	1kg & 5kg	3 - 4	Untreated	Spring - Summer	10 - 12wks after sowing	Shallow, fibrous	Most soil types, will tolerate dry conditions	Quick to establish and a good weed suppressor. Flowers loved by bees and butterflies. The crop must be incorporated into the soil before setting seed or it may reappear in subsequent crops as a weed. Said to release many minerals into soil as it decomposes, especially P, Ca and Mg.
Buckwheat	5kg	20 - 30	Untreated	Spring - Summer	Summer - Autumn	Shallow, but with good penetration	Tolerates poor, but not wet soils	Fast growing and quick to mature, not winter hardy. Dislikes wet, heavy or compacted soil. Do not allow to set seed before incorporating into soil. Attractive to beneficial insects especially hoverflies. Good scavenger of phosphate.
Crimson Clover	1kg & 25kg	5 - 6	Untreated	Spring	Summer - Autumn	Taproot with fibrous branch roots	Prefers loam, will tolerate poor soils as long as alkaline and free draining.	Nitrogen fixing. Very attractive to insects. Excellent weed suppressor. Biomass degrades quickly into soil. Will over-winter in S England for autumn sowing/spring incorporation. Shade tolerant.
Aslike Clover	25kg	25	Untreated	Spring	Autumn	Branched tap root Deep rooting	Most types	Nitrogen fixing. Less biomass than red and white clover but better adapted to wet, acid soils and cooler conditions. Requires shallow sowing and firm seedbed.
Borage	5kg	5+	Untreated	Spring	Autumn	Long tap root.	Most types, including heavy. Thrives best on loamy, calcareous soils.	Large leaves and succulent growth provide an abundance of easily broken down material, without depleting the Nitrogen content of the soil. Royal blue flowers, very attractive to bees.
Over Winter Crops Autumn Sowing & Spring Incorporation								
Forage Winter Rye	25kg & 500kg	50 - 75	Untreated	Autumn	Spring	Extensive, fibrous root system	Grows well on light, sandy, free-draining soils	Produces large amounts of green material. Excellent nitrogen scavenger and for the prevention of nitrate leaching during winter months. Do not allow to run to seed as this will 'lock-up' available nitrogen. Very hardy. Do not follow too soon with brassica crop or germination will be adversely affected.
Italian Ryegrass	25kg	15	Untreated & Organic	Autumn	Spring	Extensive, fibrous root system	Diploids better in wet areas and tetraploids in drier	As with forage rye, produces high yields of biomass. Good root system for improving soil structure. If seed heads are produced, crop must be cut before seed is shed to prevent infestation of following crop. Good 'mopper-up' of excess soil nitrogen.
Cocksfoot	15kg - 20kg	2 - 4	Untreated & Organic	Spring / Autumn	Autumn - Spring	Thick and fibrous with large energy reserves	Dry, free-draining	When undersown at a low seed rate into winter wheat, cocksfoot is an excellent soil improver for drought-prone soils.
Forage Rape	5kg & 25kg	2.5 - 4	Untreated, Cruiser OSR & Organic	Spring / Autumn	Autumn - Spring	Deeply penetrating tap root.	Most types, able to tolerate poor soil & exposed sites	Fast growing. Good alternative to mustard if using high glucosinolate varieties, as decomposition can release chemicals which produce a biofumigation effect if incorporated within 24 hours of cutting. Where club root is a problem, make sure a resistant variety is used.
Vetches	25kg	25 - 35	Untreated & Organic	Spring / Autumn	Autumn - Spring	Tap root	Prefers loams and clay. Will not thrive in wet or waterlogged conditions.	Nitrogen fixing. Good weed suppressor. Ensure winter hardy variety is used. Due to its large seed size, will establish later than most other legumes. Requires fine, firm seed-bed. As with forage rye, do not follow too soon with brassica crop or germination will be adversely affected.
Longer Term Crops								
Lucerne Pre-inoculated	25kg	8 - 10	Untreated & Organic	Spring - Early Autumn	Autumn - Spring	Very deep tap root	Light/chalky/ free-draining	Nitrogen fixing. Seed must be inoculated with rhizobium bacteria. Prefers dry growing conditions. Uncompetitive particularly in early stage of development so grow as pure stand or with non-aggressive companion grasses.
White Clover	1kg & 25kg	2 - 3	Untreated & Organic	Spring - Early Autumn	Autumn - Spring	Creeping stolons. Shallow rooting	Wide range. Tolerates dry conditions.	Nitrogen fixing. Continued defoliation stimulates root growth and nitrogen fixation. Smaller leaved varieties are more persistent than larger leaved. Good weed suppressor. Shallow sow into fine, firm seed bed.
Red Clover	1kg & 25kg	5 - 6	Untreated & Organic	Spring - Early Autumn	Autumn - Spring	Large, strong tap root	Wide range, avoid poorly drained, acid soils	Aggressive, nitrogen fixing plant, does not release N until crop is ploughed in. Shorter term than white clover. Good for improving and aerating soil structure & useful weed suppressor. Ensure fine, firm seed bed.
Yellow Blossom Clover	1kg	5 - 6	Untreated	Spring	Summer - Autumn	Long tap root.	Prefers poor soil and dry conditions. Dislikes wet, heavy ground.	Biennial. Nitrogen fixing, quick to establish and grows vigorously. Improves soil structure. Plough in before flowering and before stems becomes woody. Attractive to bees and other insects if allowed to flower.
Agricultural Chicory	1kg & 20kg	3	Untreated	Spring - Early Autumn	Autumn - Spring	Deep tap root	Prefers well drained soils	Biennial plant. Excellent soil improver when grown with cocksfoot and clover, with the resulting combination of deep, fibrous and nitrogen fixing root systems.