

Module 4

THE TRANSPORT, STORAGE, HANDLING AND APPLICATION OF FERTILISERS

APPLICATION OF FERTILISERS

Liquid fertilisers

Application of liquid fertilisers to horticultural crops is usually via the irrigation system or hand watering with a dilutor. See section on liquid feeding.

Solid fertilisers

Solid fertilisers are often applied to glasshouse/tunnel soil by hand because of the small areas compared to agricultural situations. For field-grown crops a tractor mounted fertiliser spreader may be used.

The following should be checked:

- Accuracy of spreading
- Spread pattern
- Working height (especially if top-dressing taller crops) • Bout width

Fertiliser spreaders must be correctly calibrated, and the spread pattern checked with each different product used.

When using spreading machinery, the normal Health and Safety precautions must be used:

- Use appropriate PTO and other safety guards
- Don't adjust when the tractor is running
- Don't allow anyone to ride in/on the hopper
- Never push damp fertiliser through
- Never work underneath an unpropped hopper or machine

Fertiliser, especially liquid products, should not be applied in windy conditions where drift may occur.

See AICC leaflet on fertiliser spreaders.

HANDLING OF FERTILISERS

Several handbooks exist relating to storage/handling/application of fertilisers and anyone involved professionally should consult the following:

Agricultural Industries Confederation

Confederation House East of England Showground

Peterborough

PE2 6XE

Tel 01733 385230 www.agindustries.org.uk

- Product Safety Data Sheets
- Legislation Guidance and Codes of Practice.

DEFRA https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/268691/pb13558-coqap-131223.pdf

Code of Good Agricultural Practice for farmers, growers, and land managers.

"Protecting our Water, Soil and Air"

STORAGE OF FERTILISERS

- The most important documents regarding storage of fertilisers will be the relevant Product Data Sheet.
- In general fertilisers are not classified as dangerous for supply.
- Ammonium Nitrate containing fertilisers that are not made in the E.IJ. may be classified for conveyance.
- In practice all Ammonium Nitrate fertilisers (more than 28% N) are marked with a yellow diamond oxidising symbol containing the number 5.1 to draw attention to their high content of ammonium nitrate.
- Some other fertilisers that contain over 70% ammonium nitrate (by volume) will also be marked with this symbol.

C.O.S.H.H. regulations apply to fertilisers not because they are harmful to health but because of the possibility of dust and the products of decomposition in a fire situation.

The relevant regulations that control the manufacture, importation, keeping, carriage and supply of AN fertiliser in Great Britain are:

- The Ammonium Nitrate Materials (High Nitrogen Content) Safety Regulations 2003 (AN Safety Regulations)
- The Control of Major Accident Hazards Regulations 1999, as amended (COMAH)

- EC Fertiliser Regulation 2003/2003
- The Fertiliser Regulations 1991
- The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007

The Dangerous Substances (Notification and Marking of Sites) Regulations 1990

These regulations require warning signs to be posted at the entrance to individual premises where more than **25 tonnes of a dangerous substance** are or are likely to be kept. Both the local fire brigade and the local HSE must be notified in advance.

All fertilisers marked with the yellow diamond oxidising symbol are covered by these regulations. Apply to the TOTAL amount of dangerous substance present.

The appropriate symbol is a black triangle on a yellow background containing an exclamation mark.

Other regulations apply to farmers, merchants, importers and manufacturers who store large quantities of products (if more than 150 tonnes of AN fertiliser to be stored HSE must be notified with 4 weeks' notice).

Those involved should consult specialist documentation and regulations. In general, lesser amounts of non-EU fertilisers can be stored.

Ammonium Nitrate must not be:

- **HEATED**
- **CONFINED**
- **CONTAMINATED**
- Storage areas must be single storey, dedicated buildings, constructed of non-flammable materials.
- Outdoor storage must be protected from moisture and sunlight
- Drains must be protected from run off and contamination with molten material.
- Stores must not be near gas or fuel oil or timber installations
- Stacks of ammonium nitrate must be limited to 300 tonnes and no more than 2m high.
- One meter must be left between stacks and walls and roofs.
- Urea and ammonium nitrate must not be stacked together; similarly, 28%- N products should be stacked well away from 29%+N products.
- Ammonium nitrate ON FARMS should have suitable fire- breaks of at least 5m between fertiliser and any combustible or contaminating material. (This can be reduced to 1.5m if there is a non-combustible wall)

GOOD HOUSEKEEPING

- Store containers in suitable stacks.
- Clear up spillages immediately.
- Do not use sawdust on floors
- Place damaged sacks in over-bags
- Dispose of spillages and contamination on growing crop (if poss.) ● Licensed disposal is also an option.
- Keep everything clean.
- Check electrical fittings.
- NO WELDING!

FIRE FIGHTING

- All staff must be trained and practised in what to do.
- Do not inhale fumes.
- Be prepared to call the fire brigade
- Use only water (no chemical or sand)
- Open doors and windows to disperse fumes.
- Block drains.
- Inform EA if contamination enters a watercourse.

SPILLAGE

- Spillages must be cleared up promptly, keep in a clean, labelled container.
- Dispose of on a growing crop, where this is not possible spread thinly on open ground or take to a licensed waste facility.

TRANSPORTATION

The Road Traffic (Carriage of Dangerous Goods in Packages etc.) regulations 1996 specify that all vehicles used to transport more than 500kg of AN fertiliser, must display an orange plate, carry two fire extinguishers for fighting a vehicle fire and have available written hazard information about the fertilisers. The orange plate must be removed when the vehicle is not carrying such fertilisers.

The Road Traffic (Training of Drivers of Vehicles Carrying Dangerous Goods) regulations. 1992 require the driver of a vehicle carrying AN on a vehicle having a permissible max. weight exceeding 3.5tonnes to hold a vocational training certificate.

Agricultural tractors are exempt from the new transport regulations applying to road vehicles. This means there are no legal weight or distance restrictions applying to product being moved from one part of a farm to another on a public highway.

However recent concerns about fertiliser safety and security means that it is unlikely that the fertiliser industry will load tractor drawn trailers for transport on the public highway unless drivers have a vocational training certificate and adhere to the following practices

applies to Class 5.1 products and compounds containing 70% AN	
Any tractor and trailer carrying ammonium nitrate on the public highway	Display an orange plate front and rear and have instructions in writing (Transport Emergency Card)
Other farm vehicles used for road transport Transporting ammonium-nitrate based fertiliser (up to 3.5 t vehicle) Transporting ammonium-nitrate based fertiliser (3.5 t – 7.5 t vehicle) Transporting ammonium-nitrate based fertiliser (over 7.5 t vehicle)	Display an orange plate front and rear and have instructions in writing (Transport Emergency Card) 2kg *fire extinguisher for cab + one other to make 4 kg total 2 kg for cab + others to make total 8 kg (one at least 6 kg) 2 kg for cab + other to make total 12 kg (One at least 6 kg) *Fire extinguisher — dry powder or equivalent used only to control a vehicle fire not a fire in the load (Water only should be used to extinguish a fire in the load) Full fire extinguisher requirements are being phased in but must be in place, by law, by 2007
Every supplier of the above products must, by law, employ or contract, a Dangerous Goods Safety Adviser to which further questions should be addressed.	

Farmers can pick up less than 500kg of AN fertiliser in packages but not in bulk from the merchant, BUT they must have sufficient training for emergency action, although they do not have to display orange plates, and there is no requirement for training or for the carriage of additional fire extinguishers

THE FERTILISER REGULATIONS 1991

- The nutrient content of individual fertilisers and liming material is controlled by these regulations.
- The permitted variation from the stated nutrient content is stated in these regulations, as is the way in which the content is quoted.

The percentage of nutrient may be stated as follows:

Nitrogen-total Nitrogen (N) — -nitric or nitrate (N03)

-ammoniacal or ammonium (NH4) -ureic nitrogen

For organic fertilisers only the total nitrogen need be quoted.

Phosphate

- Total phosphorus pentoxide(P₂O₅)
- phosphorous pentoxide soluble in water
- phosphorous pentoxide soluble in alkaline ammonium citrate
- phosphorous pentoxide soluble in neutral ammonium citrate
- phosphorous pentoxide soluble in 2% citric acid
- phosphorous pentoxide soluble in 2% formic acid as appropriate.

Potash

-water soluble potassium oxide (K₂O)

Magnesium -magnesium oxide (MgO)

Sulphur - sulphur trioxide(SO₃)

The content of phosphorus(P), potassium(K), and magnesium (Mg) may also be declared in brackets following the percentage as the oxide.

The Fertiliser Regulations do not specify physical quality requirements, but it is important that fertilisers store, handle and spread effectively, watch out for:

- high dust content
- small or uneven particle size
- low density materials which will have different spreading qualities.

LIQUID FERTILISERS

- These require the same declaration except that instead of being on a weight basis the declaration must be on a weight per volume basis.
- Additionally, a declaration of weight may be made.

TRACE ELEMENTS

- If these are added to a fertiliser, these amounts should be declared by weight, by percentage if the level is above 0.1%, or as mg/kg if less than 0.1%.

LIMING MATERIALS

- Should always have their Neutralising value (NV) declared and, depending on the material, there may be a need to declare the results of a sieving test.
- The Neutralising Value provides a comparison with pure calcium oxide which has a NV =100.

Most common solid fertilisers can be called EC fertilisers. All fertilisers can be sold without the EC designation, but only certain solid fertilisers may be so designated.

Liming materials, liquid and semi-liquid fertilisers, or any fertiliser containing a pesticide or herbicide or any organic based nutrient other than urea, or any added trace element, or any fertiliser so formulated that it contains nutrient levels outside the EC requirements may not be so designated.

IN ADDITION TO THE STATUTORY ANALYSIS THE FOLLOWING MANDATORY INFORMATION IS REQUIRED ON PACKAGES LABELS OR ACCOMPANYING DELIVERY DOCUMENTS.

-The correct NAME or MARK, e.g., 'Niram' or 0.24.24.

where only the mark exists then a register must be available for inspection -'EEC Fertiliser' must be stated where product meets this standard

-Trace element content must be declared

- Name and Address of manufacturer or supplier

-The guaranteed weight for solids

-The guaranteed weight or volume for fluids

Advice on handling and storage is required for fluids (not for solids)

THE HIERARCHY OF LEGISLATION

Before legislation, ideas are set out as: -

- Green Papers
- White Papers
- Consultative Documents

Legislation takes several forms:

Primary Legislation:

- Acts of Parliament (usually in the form of enabling Acts)
- Secondary Legislation:
- Statutory Instruments (SI)

Can take the form of:

- Regulations
- Orders
- Rules

If necessary, Acts of Parliament are framed in such a way to take account of Directives from the EU

ENFORCEMENT

Non-compliance with statutory controls is often a criminal offence and sanctions can be taken against those who commit an offence.

This can be done by:

- A Government agency
- Local Authority

Civil Actions

These can be taken by individuals where harm has been done to them and they seek compensation.

There is a difference in emphasis between a civil and a criminal prosecution.

In the case of a criminal act the case must be proved "beyond a reasonable doubt". In a civil action the case is based on a lower standard of proof, "the balance of probability".

In criminal cases, penalties are often set, or a maximum is stated.

In civil cases there are no set costs and in some instances the award can be very high.

Appendix 1

ACIDIFICATION OF WATER SUPPLIES

- The hardness of water is primarily a reflection of its bicarbonate (**HC03-**) content.
- To neutralise the bicarbonate, an equivalent amount of acid must be added to the water.
- The bicarbonate content is determined by analysis of a water sample.
- **pH** of water is a poor guide to its hardness and the acid addition required to neutralise this.
- Account needs to be taken of differences in water sources on any site.
- For instance, a site in Sussex overlying chalk will tend to have high bicarbonate levels in on-site borehole supplies and probably a high figure in mains supplies which are usually from similar sources in this area.
- There will be a low figure in reservoirs filled by rainfall, such as run-off from glasshouse roofs.

Calculation of acid requirement

- Bicarbonate in water supplies is neutralised by addition of eq. **molecular weight** of acid.
- One **mol of bicarbonate** is neutralised **by one mol of acid**.
- Molar solution contains the molecular weight of the molecule dissolved in a litre of water.

To calculate the acid required to neutralise the bicarbonate, translate the analysis in

mg/l into mmols 1 mol = 1,000 mmols.

It is necessary to know the atomic weight of the elements involved.

	Formula	Atomic weights	Molecular weight
Molecule			
Bicarbonate	HC03-	1+12+(3x16)	61
Nitric acid	HN03-	1+14+(3)(16)	63
Phosphoric acid	H3P04-	(1x3)+31+(4x16)	98

Example:

A water supply contains **300 mg/l bicarbonate** is equivalent to **300/61 = 4.92 mmols**.

It is normal to leave some bicarbonate un-neutralised for final adjustment, **about 0.5 mmols**,

Therefore **4.5 mmols net**. To neutralise this, **4.5 mmols** of acid are needed.

Nitric acid

The amount needed to neutralise this amount of bicarbonate is $4.5 \times 63 \text{ mg/l} = 284 \text{ mg/l}$.

This needs to be adjusted for the strength of the acid, normally **60%, not 100%**.

$$284 \times 100/60 = 473 \text{ mg/l.}$$

But **acid addition is measured in volume, not weight**, so the **specific gravity** of the acid has to be taken into account, as this is greater than water.

For **60% nitric acid** the **SG is 1.35** i.e. **1 ml acid weighs 1.35 grams**.

$$473 \text{ mg/litre} / 1.35 = 350 \text{ mill } \underline{1000} \text{ litres.}$$

(Note the addition is to 1,000 litres as 1ml of water weighs 1 gram i.e., 1,000 mg).

This amount of acid would add 78 mg/l N ($350/63 \times 14$).

Phosphoric acid

With phosphoric acid the sums are:

$$4.5 \text{ mmols} \times 98 \text{ molecular weight} = 441 \text{ mg/l.}$$

Commercial phosphoric acid strength = **67%, SG = 1.50**

$$441 \times 100/67/1.5 = 439$$

$$= 439 \text{ mill/000 litres}$$

$$= 139 \text{ mg/l P}$$

This addition of P is high. In practice, for hydroponic crops, a mixture of 2/3 nitric acid and 1/3 phosphoric acid is often used in hard water areas.

Appendix 2

The Control of Substances Hazardous to Health Regulations (COSHH)

The COSHH Regulations made under the Health and Safety at Work Act 1974. They bring together and replace the provisions of COSHH 1988 and later amendments. They apply to a wide range of substances. The Regulations apply to:

- (a) substances that have already been classified as being very toxic, toxic, harmful, corrosive, or irritant under the Chemicals (Hazard Information and Packaging) Regulations 2002 (CHIP);
- (b) substances specified in Schedule 1 to CHIP (which lists substances that have maximum exposure limits (MELs) or for which the Health and Safety Commission has approved an occupational exposure standard (OES) (details of such substances are given in the current edition of HSE Guidance Note EH/40) dust of any kind when present at a substantial concentration in air (explained in HSE website on COSHH)
- (e) any other substance which creates a hazard to health which is comparable to the hazards created by the items at (a) to (d) above (the HSC website on COSHH gives advice on factors to be considered.)

Employers and the self-employed must make a suitable and sufficient COSHH assessment before work starts.

For more information, please contact the Health and Safety Executive,
Magdalen House, Stanley Precinct, Bootle L20 3Q7 DANl's Health and
Safety Inspectorate, Annex D, Dundonald House, Upper Newtownards Road,
Belfast BT4 3SB, and Health and Safety Division of the Department of
Economic Development, 83 Ladas Drive, Belfast BT6 9FJ.

Appendix 3

In addition to the Safe Storage and Handling of Fertilizer advice, issued by the manufacturers, and the HSE "Storing and Handling Ammonium Nitrate" booklet, farmers should take note of the following with reference to on farm security:

Secure storage on farm

- Do not store fertilizer where there is public access.
- Do not leave fertilizer in the field overnight.
- Do not store fertilizer near or in sight of the public highway.
- Do not sell fertilizer unless the purchaser is personally known by you to be a bona-fide user.
- Do record fertilizer deliveries and usage.
- Do, wherever possible, store fertilizer inside within a locked building.
- Do fully sheet fertilizer stock stored outside and regularly check to ensure that the stack has not been tampered with.
- Do carry out regular stock checks.
- Do report immediately any stock discrepancy or loss to the Police.
- Do record any manufacturer code numbers from the bags and the Detonation Resistance Test certificate number(s) as supplied by the manufacturer.



Keep your Fertiliser Secure and out of Sight

Fertilisers containing Urea, Ammonium Nitrate, and CAN have all been used by terrorists. Please keep these fertilisers securely on your farm.

Wherever possible use a Fertiliser Industry Assurance Scheme (FIAS) approved supplier.

Wherever possible keep in a secure area such as a building or sheeted away from public view.

Carry out regular stock checks and report any loss to the Police immediately (call 101).

Avoid leaving fertiliser in a field overnight — never leave fertiliser in the field for a long period of time.

Remember it is illegal to sell ammonium nitrate without the correct documentation.

ASSOCIATION OF
CHIEF POLICE
Environment HSE
Food & Rural



Dep
for E
Foo

OFFICERS
FENFU

Department

Affairs

for



For more advice go to: www.secureyourfertiliser.gov.uk

If you have any suspicious or information about somebody's activities or behaviour, call the police Anti-Terrorist Hotline on 0800 789 321. In an emergency, always dial 999