

## CHAPTER 6

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## SERVICES FOR AGRICULTURE, HORTICULTURE AND FORESTRY

## 6.1 Introduction

6.1.1 This market sector also includes fishing. Services to the sea fishing industry are included in chapter 18 (sea transport), while the sport of fishing is part of the leisure and tourism sector (chapter 13). The requirements of commercial freshwater fisheries (trout farms etc.) may be investigated locally. They are not considered further here.

6.1.2 By far the largest part of the market is provided by agriculture which is one of the largest industries in the United Kingdom, employing over 2% of the country's workforce in 1989. Agriculture is also one of the industries most dependent on the weather so that advice given to the farmer about the future trend of weather and a knowledge of its effects on his operations can be of real economic benefit to both him and to the country.

6.1.3 The agricultural sector is divided up into a number of discrete segments, notably the Government administrative and advisory bodies and agricultural research organizations, other advisory and R&D organizations sponsored by farmers and growers, agricultural consultants, and suppliers and distributors of products such as machinery, seed and fertilisers. Last, but by no means least, the farmers and growers themselves, either individually or grouped into, for example, cooperatives or farmers' organizations such as the National Farmers Union.

6.1.4 Government's responsibilities for the provision of advice to the agricultural community on the technical problems of agriculture, horticulture and farm management are discharged, in England and Wales, by ADAS, an Executive Agency of the Ministry of Agriculture, Fisheries and Food (MAFF). Similar functions are carried out in Wales by the Welsh Office Agriculture Department (WOAD). In Scotland, advisory functions are provided by the Scottish Agricultural College (SAC), while in Northern Ireland, the advisory service is run by the Department of Agriculture, Northern Ireland (DANI).

## 6.2 Organization for agriculture and horticulture

6.2.1 Meteorological Office services to agriculture and horticulture are provided through the Production and Service Provision (PSP) Branch of Commercial Services (CS), through the National Agrometeorological Unit (NAMU), headed by the National Agrometeorological Officer (NAMO), based at the ADAS Consultancy Centre, Wolverhampton, through Main Met. Office Belfast (for Northern Ireland), and through other CS offices. Routine data services to the Scottish Agricultural College are provided by the Standard Products Group though, in addition, Glasgow and Aberdeen WCs provide forecast weather information during the summer/autumn season on a regular basis. General management of the commercial aspects of the agricultural market sector are undertaken by the Market Sector manager for Agriculture (MSM(A)).

6.2.2 The Agrometeorology Consultancy Group (part of the PSP Environment Consultancy Group) provides some support to the NAMO as well as working closely with other scientific and agricultural institutions. An important element in the headquarters operation is the maintenance and development of the agrometeorological computer database, known as FARMAID. This provides Met. Office staff with on-line access, by way of remote terminals, to climatological and some forecast information. ADAS receives FARMAID data via a direct connection to the ADAS 'Prime' computer system based at Guildford.

6.2.3 ADAS is expected to operate commercially in the provision of its services and continues to examine its relationship with the Office. At present ADAS is divided into 15 Business Units (See Annex). The regions of responsibility for the Scottish Colleges of Agriculture are shown at Appendix A to Annex D.

6.2.4 The duty of the NAMO is to provide data, information and advice on all meteorological topics related to agriculture. The NAMO is responsible for the meteorological components of the ADAS commercial advisory services and contribute to MAFF Policy group requirements and commissioned R&D programmes. He/she promotes, within ADAS and the agricultural industry, an understanding of the benefits to be derived from the systematic application of meteorological advice to agricultural matters.

6.2.5 Areas of work carried out by the NAMU are detailed in 6.4.

6.2.6 NAMU has no facilities for preparing weather forecasts, although they do have access to certain charts provided by facsimile from PS offices. The forecast and warning services described in subsequent paragraphs are provided by the PS offices. These services are advertised by MAFF in various publications.

### 6.3 Forecasting services

6.3.1 Farmers and growers make extensive use of the forecast information available via the media. Especially popular are the Sunday BBC TV "Country File" forecasts for a week ahead, as well as the daily television and national radio forecasts. Local radio, though considered by farmers to be of higher accuracy (presumably because it is more tailored to the local area) is rather less widely used. Considerable use is also made of the premium-rate telephone weather service "Weathercall".

6.3.2 A number of media broadcasts are provided as part of specialist farming programmes. The BBC "Country File" forecast on Sundays has already been mentioned. This forecast is the only routine national broadcast of extended medium-range forecast information, aiming to cover the whole of the coming week. The service is based on the routine medium-range guidance (see sections 4.4 and 4.5) supplemented by a conference with the medium-range forecaster in CFO, and the presentation itself makes extensive use of the 6-day numerical model forecast charts and graphics. Forecasters should try to avoid giving the impression of overdue precision by the use of these chart sequences, particularly towards the end of the week. The information on expected developments towards the weekend is routinely updated (but not extended) in the lunch-time television broadcast on BBC1 each Wednesday. Extended forecasts for farmers are also included as part of services to some IBA television regions and on BBC TV Northern Ireland.

6.3.3 On BBC national radio, forecasters at LWC contribute inserts for all the early morning "Farming Today" (Monday to Friday) and "Farming Week" (Saturday) programmes on Radio 4. When preparing material for this broadcast forecasters should place emphasis on those elements of the weather of relevance to current farming activities, taking due note of the information contained in Annexes A and B; suggestions may also be made by the programme presenter in pre-broadcast discussion.

6.3.4 Approaches may be received at outstations from regional television, regional or local radio for the introduction of specialist farming weather forecasts similar to those already broadcast, i.e. including forecast information for up to 5 or 7 days ahead. All requests of this sort should be referred immediately MSM(A). New services of this type are unlikely to be approved unless the assessed impact of such services on existing revenue is outweighed by the revenue derived from the service; MSM(A) will take into account the net resource implications. Where such a service is approved MSM(A) will arrange with the Environment Consultancy Group for any necessary supporting agrometeorological information to be supplied.

6.3.5 In common with other members of the general public, many farmers and growers telephone outstations to seek weather advice in relation to their current activities. Advice available via the Free Public Telephone Service is strictly limited (see chapter 21) and all callers to this service known to be farmers should be encouraged to make use of the commercial services which are available. In some cases standard forecast or warning services may meet requirements but the most appropriate service in many instances will be a telephone consultancy.

6.3.6 A registered subscriber to the agricultural direct access service is provided with an ex-directory telephone number on which contact can be made at any time of day or night with a forecaster at a CS office. The areas of responsibility for these consultancy services are shown in Annex C to chapter 1. Many of the weather-sensitive activities (Annex B) about which the farmer will seek advice depend critically on the likelihood of dry weather, often over an extended period and many of the queries relate to 3 to 5 days ahead. Depending on the time of year and activity to be undertaken queries may equally relate to night frost, wind speed, sunshine and so on (see Annex 6J for more detail). Rather than assume the reason for the call, forecasters should always discuss the problem fully before answering. As direct access services are site specific, it follows that the forecaster must also know as much as possible about the exact location and any known peculiarities of the sites of registered subscribers. When arranging the service, the S Met O or Commercial Manager should elicit all relevant details and if necessary visit the farm. The establishment of a close rapport between the forecasters and clients is to be encouraged. An extensive knowledge of the customer also helps the efficient provision of the service by reducing the amount of time necessary to determine the specific requirement on the day. Some form of record of the number of calls from each customer should be maintained. This is helpful in the adjustment of charges, where the service provided exceeds the minimum.

6.3.7 The Weatherfax service is a service run by London, Norwich and Nottingham Weather Centres. Large farms and agricultural cooperatives should be encouraged to join the service, since it is designed to meet their daily needs for information to assist with forward planning. It also eases the load that the Direct Access Service can place on

forecasters at critical times, such as 6 to 8 a.m. The forecast is presented in a tabular format giving projected values and probabilities out to six days ahead. Ranges are used to convey uncertainty, these ranges getting larger as the forecast period increases.

6.3.8 Lamb wind-chill service Tailored forecast and warning services may be devised to meet specific needs. The lamb wind-chill service was devised to provide warning of situations which may lead to losses of newly born lambs, which can be severely stressed by adverse combinations of wind speed and low temperature particularly when wet. The loss of body heat in such situations can, if the lamb is unable to restore adequate energy reserves by sucking, lead to hypothermia, loss of appetite and eventually death. The forecast service is designed for the lowland lamb producer, who produces the lambs indoors before turning them outside. It is not intended as a service to the upland/hill flock owner. In essence the service requires preparation of a site-specific forecast for given meteorological elements; which are combined in a given way to produce an index (stress factor) which is the figure passed to the customer. Full details of the procedure are given in Annex E.

6.3.9 Heat-stress service This is a warning service provided by certain PS offices of high temperatures which cause stress to chickens either in broiler houses or in transit. Maximum air temperatures in excess of 25 °C or temperatures >23 °C for four hours or more, especially if accompanied by high humidity and light winds, are the main problem. Warnings are required at least 48 hours in advance and are usually given on an area basis. Details are given in Agricultural Memo. No. 1013 *Heat stress in broiler chickens*, by J. Cochrane.

#### 6.4 Specialized agrometeorological services

6.4.1 In addition to the tailored services offered by CS offices, the Agrometeorology Consultancy Service or the NAMO can offer a range of products designed specifically for agriculture, such as T-sums, Ontario units and general accumulated temperatures (using any base temperature or starting date), soil moisture and dispersion impacts, renewable energy studies, pest and disease prediction, spray occasion analyses, growing and grazing season information. Grass and cereal development models, originally developed for research, have begun to be applied to routine farm management. Derivatives of the model enable advice to be given on the productivity of a particular crop in different climatic regions, and on the contribution of weather to the year to year variation in yield. Enquirers for this type of information should be referred to the Agriculture Consultancy Group or MSM(A).

6.4.2 Services relating to plant diseases and pests A wide variety of diseases, caused mainly by fungi, but also by bacteria and viruses, affect crops to varying degrees (Annex C). Some diseases do not affect the crop enough for control measures to be economic; others can drastically reduce the yield and quality unless control measures are taken. During the growing season a number of weather-based disease indices are calculated at Bracknell and are transmitted daily to plant pathologists and agrometeorologists in ADAS. The indices give a measure of the extent to which current weather is suitable for disease development; by combining this information with field observations ADAS advisors are able to offer advice on required treatments to a wide range of farmers and growers on repayment.

6.4.3 The Office does not provide advice on treatment of plant disease problems. Responsibility for the issue of plant disease warnings and advice concerning spraying rests squarely with plant pathologists. Any enquirer seeking information on plant disease from an outstation in England and Wales should be referred to an ADAS Crop Consultant; in Scotland, to the advisor at the appropriate local outstation of the Colleges of Agriculture and, in Northern Ireland, to the Department of Agriculture.

6.4.4 Enquiries may be received from the producers and distributors of agricultural chemicals and sprays for forecast or actual meteorological variables related to plant pests and diseases, to enable them to plan their sales or distribution activities for these chemicals. Where such distributors are national companies they should be referred to MSM(A), who will advise on charges and/or make arrangements for the provision of the service if this is required for a wide area.

6.4.5 Services relating to animal diseases and health Relationships have been established between the weather and certain animal diseases. In general these are very complex and causes can be affected by husbandry practices. Decisions on the need for treatment are made by MAFF veterinarians using information supplied by the Agriculture Consultancy Group. One of the most serious of these diseases is Foot and Mouth Disease (FMD). Detailed procedures have been set up to provide meteorological advice in the event of an outbreak of FMD. These are set out in section 6.5.

6.4.6 Respiratory disease in young calves may be encouraged by poor environments within housing. It is often associated with stagnant, foggy weather in autumn and inappropriate housing. Advice on siting and ventilation can be provided by NAMO.

6.4.7 Quite apart from specific diseases, animal health can be profoundly influenced by cold stress and heat stress both in the field and in transit. Pregnancy toxæmia is a stress condition occurring in ewes carrying twin lambs; it is greatest under the combined influence of cold and wet weather. Stress in new-born lambs is discussed in relation to the lamb wind-chill service (paragraph 6.3.8) while heat-stress in broiler chickens is covered in paragraph 6.3.9.

6.4.8 Strategic and tactical irrigation planning Irrigation can be a most useful tool for the farmer and grower. Its main purposes are:

- a. To provide additional water for enhanced growth of plants by supplementing rainfall. In a typical partly sunny day the water loss from a growing crop is of the order of 30 tonnes per hectare (equivalent to 3 mm of rainfall) but up to twice that amount is lost on a hot dry sunny day.
- b. To facilitate cultural practices such as seed-bed preparation or harvesting by changing the condition of the soil.
- c. To ensure establishment of a crop from seed or by transplanting.
- d. To maintain an adequate supply of nutrients to the plant (e.g. washing in of a top dressing).
- e. To improve crop quality and uniformity.
- f. For frost protection.

In addition, irrigation will sometimes enhance the action of residual herbicides and on occasions it is used for the distribution of fertilizers and pesticides. The help that NAMO and the Agrometeorology Consultancy Service can provide with regard to short- and long-term irrigation planning is described below.

6.4.9 Short-term irrigation planning is concerned with the calculation of the amount of water needed at any given time to reduce a soil moisture deficit (SMD), which has arisen following the weather of the preceding few days. To calculate the timing of application and amount of water needed, the farmer or grower may be advised to keep a soil moisture balance sheet using on-site rainfall measurement and a derived value of potential evaporation (PE), areal values of which can be obtained from (CS) Agrometeorology Consultancy Service (see paragraph 6.4.13) directly on subscription via CS offices.

6.4.10 Commercial irrigation services are also widely available. Details of the IRRIGUIDE service offered by ADAS can be provided by NAMO.

6.4.11 Long-term irrigation planning involves the system design and the choice of equipment. It is also necessary to ensure that water will be available when needed. The Agrometeorology Consultancy Service has developed a computer program which uses the farmer's cropping pattern with data from the nearest appropriate meteorological observing station to calculate daily SMD for a number of years and then to derive the amount of water and frequency of application that would have been required to follow a particular irrigation scheme. This service is available from the Agriculture Consultancy Group, the NAMO or local ADAS advisors.

6.4.12 Met. Office Rainfall and Evaporation Calculation System The Met. Office Rainfall and Evaporation Calculation System (MORECS) uses models of water extraction to arrive at estimates of SMD under a variety of unirrigated crops and for three different types of soil (high, medium and low available water capacity). Data are provided as areal averages for a grid of 40 km squares covering the whole of Great Britain. Estimates of SMD, PE, actual evaporation (AE) and hydrologically effective rainfall (HER) are issued weekly to customers on subscription (see paragraph 20.6.6). A site-specific version of MORECS also exists which is useful in many environmental situations.

## 6.5 Meteorological advice during outbreaks of Foot and Mouth Disease

6.5.1 Background information on FMD is given in Annex F. In the event of an outbreak of FMD the Office is required to supply meteorological advice to MAFF on the likely dispersion of FMD virus by the airborne route. This operational advice is provided by (CS) Agrometeorology Consultancy Service with the assistance of CFO. In order to do this the group maintains a roster of staff — the FMD Duty Officer — ready to respond quickly outside normal working hours. Aided by sophisticated computer programs, all the information likely to be required, including an estimate of the area affected by the virus, is provided to MAFF. Work carried out by the Office during a FMD outbreak is chargeable to MAFF; thus a record of staff effort should be forwarded to MSM(A) at the end of an outbreak.

6.5.2 When an outbreak of FMD is suspected an alert message is passed from MAFF veterinary staff to the Agrometeorology Consultancy Service (outside normal hours this message is passed to CFO for transmission to the FMD duty officer). The message indicates whether the disease is confirmed or suspect, its location and the number and type of animals infected as well as details of total stock on the farm and the estimated age of the disease and whether or not action is required by the Office. On receipt of this information the duty officer will run the appropriate programs and with the help of CFO brief MAFF officials on the weather conditions since the outbreaks started and on future trends in the weather over the next day or two. In certain cases it may be necessary for MAFF veterinary staff to put an epidemiological team (ET) into the field. The team will be advised by the Agrometeorology Consultancy Service.

6.5.3 The M Met O responsible for the area in which the outbreak occurs will normally be advised of the suspect or confirmed outbreak but will not be required to take specific action unless an ET is put into the field. The meteorological advisor may then request area forecasts or other advice to be provided over the telephone or by docfax to the office nearest to the ET Headquarters.

## 6.6 Meteorological advice for forestry

6.6.1 The danger of fire generates the primary requirement for meteorological advice for forestry. The responsibility for warnings rests with the Forestry Commission who consider fire danger as made up of two components, fire risk and fire hazard. Fire risk is defined as the probability of a particular area or plantation catching fire. Significant factors are the presence of the general public and practices such as grass or stubble burning and moor-burn. Fire hazard is defined as the degree of inflammability of the forest, i.e. the amount of combustible material (forest debris etc.), the moisture content (and inversely therefore the drying capability) of the air, the wind speed, etc. The degree of fire danger at a given time may be classified as low, moderate, high or extreme.

6.6.2 Normally the period of greatest danger during the year is from the beginning of March to the end of May, because most ground vegetation is dead or dormant and lacking in sap. Frequently it has been battered during the winter months by rain and snow into a compact mass of fuel and may be dried to a tinder-like state by winds from January onwards. In some areas, the danger may begin even in mid-January, while in other districts it may extend to mid-June. In many summers there may also be long dry spells when fire danger is high somewhere.

6.6.3 The Forestry Commission is organized into 7 Conservancy Areas, 3 in England, 3 in Scotland and 1 in Wales. The offices designated to serve the various Conservancies are detailed in Annex B to chapter 1. When considering fire danger (or fire hazard), Conservancy Officers require advice concerning the possibility of rain and the amount expected, the maximum temperature, the minimum relative humidity and the direction and force of the wind. Relative humidity is particularly significant because, for example, even 10 mm of rainfall may imply only 1-2 mm of intercepted rain which in a wind of Force 3 coupled with bright sunshine and a low relative humidity can quickly lead to a return to conditions which are beyond the safety limit. Ground which is still too wet for the public to sit on may nevertheless be covered by debris which will readily ignite and burn rapidly.

6.6.4 The advice should be supplied by the designated offices by means of an arranged telephone consultancy service when required. Any Forestry Commission contact with other offices for this purpose should be directed appropriately. If the Conservancy Officer, having considered the weather forecast, decides that a high or extreme fire danger exists he will dictate a Fire Warning message by telephone to the designated office. English Conservancies act independently. Warning messages received at Leeds, Manchester, Bristol, Norwich or Southampton WCs should be passed to LWC for national broadcast. The Mid-Scotland (Glasgow) and Wales (Aberystwyth) Conservancies will pass coordinated messages for Scotland and Wales to Glasgow and Cardiff WCs respectively for onward transmission to BBC Radios Scotland and Wales/Cymru for broadcast. Exceptionally these Conservancies may ask also for national broadcast on BBC Radio 4 and BBC TV in which case Glasgow WC and Cardiff WC will also pass the messages by telex to LWC.

6.6.5 LWC will include all fire warning messages received in the next live broadcast on BBC Radio 4 and will also pass them to the Weatherman at BBC Television Centre for inclusion in the next broadcast or as a "News Flash". In some areas, the Forestry Commission may have made bilateral arrangements for broadcast on BBC or IBA local radio and/or BBC regional or IBA television, but the Office is not party to these arrangements and our responsibilities end with broadcasts on BBC Radio 4, BBC Radio Scotland, BBC Radio Wales and BBC national television.

6.6.6 The consultancy arrangements described above for the Forestry Commission in connection with the consideration of fire danger are provided on the basis of a waiver of charges in recognition of the fact that the Commission maintains a number of climatological stations which have records dating back, in some cases, to the 1920s

and provide a valuable contribution to the voluntary network. Procedures for determination of waivers and for the notification of the value of services supplied are discussed in Chapter 2. Designated offices should ensure that Conservancies have the correct ex-directory number. Any other requests for services received locally from the Forestry Commission (or commercial forestry) should be dealt with in the normal way.

## **6.7 Charging arrangements**

6.7.1 Arrangements for the provision of services to ADAS are negotiated centrally by D(CS) and his staff. All services for ADAS involving the resources of the WCs will form an explicit part of these negotiations and their provision will be coordinated through MSM(A). Outstations should not enter into any negotiations with ADAS or with NAMO concerning additional services on the assumption that they are part of the central agreement. All such requests should be referred to Headquarters.

IMPORTANCE OF WEATHER FACTORS IN AGRICULTURAL OPERATIONS**6A.1 General**

6A.1.1 A great many farming activities are dependent on certain, occasionally limiting, weather factors. However, a flexible work programme, combined with advice on relevant meteorological factors, will allow the farmer to plan his work schedule so as to make the fullest use of available manpower and machinery. Adequate warning of potentially damaging conditions may allow him to take some measure of protective action. Some notes on the weather affecting these various operations follow; in general, most outdoor operations need at least 12-24 hours of frost-free and mainly dry weather.

**6A.2 Farm crops**

6A.2.1 Ploughing and cultivating Although dry weather is desirable, the land should be moist enough to be workable.

6A.2.2 Hauling and spreading manure and fertilisers Firm ground is needed, i.e. dry or frosty conditions. For top dressing such as lime etc., winds must be Force 3 or less.

6A.2.3 Sowing and planting Dry weather is preferred followed by light rain. Some planting/sowing is best not done until soil temperatures rise above a certain threshold value, for example potatoes should not be planted in soils colder than the temperature at which chitting occurs, typically 4 °C or more. For horticultural crops planted outside, e.g. brassicas, the occurrence of frosts soon after planting and before establishment could mean severe scorching and a delay in harvest time of perhaps 2 or 3 weeks.

6A.2.4 Spraying Winds should be Force 3 or less. Absolute calm is not desirable, since some turbulence is needed to settle sprays. Certain herbicides, particularly those which are hormone based, can be damaging when drifting on to adjacent susceptible crops. The directional variability of light winds thus further reduces the superficial attractiveness of spraying in such conditions, especially when "low-volume" (small drop-size spectra) sprays are in use. Dry weather is usually required at the time of spraying and for the next few hours. However, the rainfastness and mode of action of sprayed compounds is so varied that it is prudent for the forecaster to make no assumptions regarding "suitable" meteorological conditions, but to enquire about and consider the recommendations appearing on the manufacturer's label. For example some compounds actually require subsequent rainfall to carry the active ingredient into the soil, and criteria of frost, dew and limiting temperatures (both maximum and minimum) are frequently included. Load bearing properties (related to soil moisture) are also relevant except where aerial spraying or low ground-pressure vehicles are employed.

6A.2.5 Harvesting of cereals and grass (clover, lucerne, etc. are included in this section). Dry weather is needed and information on persistence of early morning mist/fog or dew as well as forecasts of "drying winds" can be useful. In Scotland, cereal harvest may be delayed until October and can coincide with heavy rain which could lead to lodging of crops while strong or gale force winds can result in shredding and possibly secondary growth. Strong winds after heavy rain can result in

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difficult harvesting and serious loss; schedules may be accelerated if such weather is expected. The date of harvesting of a particular grass crop for hay or silage is fairly critical since the aim is to harvest at a date of optimum digestible matter content. After this date further increase in yield is accompanied by a fall in digestibility. Reconciling this requirement with current and forecast weather is often very difficult. In order to make good quality silage, grass should have a high dry-matter content when it is ensiled. Farmers wish to avoid cutting grass when wet and will often aim to leave the cut grass to wilt for up to 24 hours before ensiling it as wilting in dry weather increases dry-matter content. Grass cut for hay must be allowed to dry before it is taken under cover and this takes about three days in optimum conditions. If rain falls during drying the quality will decrease and with persistent rain crops are likely to be ruined.

6A.2.6 Harvesting of root crops (including sugar beet and potatoes) Dry weather with fairly firm ground is desirable. Some root crops, especially carrots may be harvested throughout the winter. Warning of a frosty spell which might freeze sugar beet temporarily stored in clamps is important. Potatoes lifted before the soil temperature falls below 8 °C are less prone to bacterial or soft rots when put into store. Very dry hard soil causes problems with machinery and breakage of sugar beet roots. Haulm destruction of potatoes by use of desiccants requires moist soil.

6A.2.7 Opening clamps Clamps are not opened during frosty weather and, in severe weather, additional protection may be required particularly in Scotland where the period may extend to mid-May.

6A.2.8 Dressing and transport of seed potatoes This relates particularly to Scotland where snow and icy roads are likely to interfere with the transport of seed potatoes, and frost can cause damage to the tubers while in transit.

6A.2.9 Straw and stubble burning After harvest it is a common, though now discouraged practice, to burn stubble and unwanted straw. This is a potentially dangerous activity which is very much weather-dependent. The National Farmers Union Straw and Stubble Burning Code advises the farmer to check the local weather forecast and to burn only in suitable weather. Farmers are now encouraged to use other methods for straw disposal, and burning will be banned from 1992.

6A.2.9.1 The preferred weather conditions are:

- a. Wind strength not greater than Force 3. (Burning should not take place if the direction of the wind is likely to create a hazard or annoyance from smoke or smuts, especially near roads, houses, airfields, public buildings and horticultural enterprise. Burning in still conditions should be avoided.)
- b. Convective situation with good vertical dispersion of smoke.
- c. Rain in past day or two.

6A.2.9.2 Hazardous conditions can be summarized as:

- a. Wind strength in excess of Force 3 (direction is also important).
- b. A stable situation with low inversion and poor vertical dispersion of smoke.
- c. No rain in the past week.
- d. High temperatures over the past week or so.

**6A.3 Fruit**

6A.3.1 Planting, stapling and pruning Dry and frost-free weather is desirable. Strong winds may cause damage to raspberries.

6A.3.2 Spraying See section 6A.2.4.

6A.3.3 Blossom period Plants are particularly susceptible to frost damage, but protective measures can be taken for example by covering, heating or sprinkler irrigation, IF adequate warning is given. Warnings of severe or prolonged frost are important where sprinkler irrigation is used since availability of water may be a limiting factor. To protect, say 10 acres of fruit during 8 hours of frost, requires about 250,000 gallons of water. (Dangers of leaching and/or flooding are also to be considered when large amounts of irrigation water must be applied for protection.) Mean air temperatures are important in considering effective time available for pollination.

6A.3.4 Harvesting fruit Fine dry weather is needed. Some harvesting may be affected by winds over Force 4 and harvesting of partly ripe fruit may be accelerated to minimize losses due to "windfalls". Soft fruits must not be picked wet otherwise a deterioration is likely in shops. Mist, fog or hoar frost may encourage botrytis disease.

**6A.4 Glasshouses and frames**

6A.4.1 The main function of the heated glasshouse is to provide a more favourable climate for plants than is available out of doors, especially during the months of October to March. The aim of the grower is to provide for the regular dispatch to the commercial market of such produce as tomatoes, cucumbers, lettuces, flowers, etc. starting as early as possible in the season.

6A.4.1 Many factors affect the climate in a glasshouse, e.g. outside temperature, solar radiation, ventilation, wind and the internal heat provided. During the winter months one disadvantage of a glasshouse is that the total light (and therefore its photosynthetically active component) inside the house is reduced considerably below the outside value.

6A.4.2 One of the main concerns of the grower is likely to be the amount of money spent on fuel to provide an adequate temperature regime inside the glasshouse. Interest is likely to be concentrated on ambient outside temperature, sunshine and wind speed. This last factor is of particular importance because a wind speed of 13 knots approximately doubles the amount of fuel required to maintain a given temperature in calm conditions.

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6A.4.3 Repairs, cleaning and moving Dry and quiet weather is necessary. Forecasts of strong winds are required.

6A.4.4 Sterilizing Some sterilizing is done chemically and a period of soil temperatures above a certain threshold is needed to degrade the chemical before any sowing or planting is done.

6A.4.5 Planting and cropping These aspects are not much affected by outside weather; warnings of hail or heavy rain are useful in protection of crops in open frames. Information on periods of warm humid weather or strong winds, particularly if associated with temperatures below 5 °C are important in control of glasshouse climates.

6A.4.6 Heating This is mostly controlled thermostatically but information on average or accumulated temperatures (below certain levels, e.g. 10 °C) may be asked for in connection with economic planning for glasshouses.

## 6A.5 Livestock

6A.5.1 Warnings of stormy conditions including snow (especially drifting), driving rain or sleet are important in spring and winter for care and feeding of livestock (particularly for sheep or cattle on hills or exposed pastures). Persistence of snow cover is relevant to decisions on moving stock to lower sheltered areas; in wet periods, the risk of flooding may necessitate transfer of animals to higher ground. Warnings of cold winds and driving rain are important during lambing, dipping and shearing.

## 6A.6 General agriculture

6A.6.1 Hedging This may be done even in severe frost.

6A.6.2 Ditching and draining This is usually done in frost-free conditions. "Mole" draining involves the creation of sub-surface drainage channels by drawing a "mole" through the soil; these channels will not be properly formed in a very dry soil. Heavy rain which follows too soon after a moling operation may cause blockage of the "moles" on some soil types. A drying soil with SMD of around 50 mm often indicates suitable conditions for moling. Subsoiling is the breaking up of layers such as plough pans which impede drainage and requires a fairly dry soil (SMDs typically 100 mm or more).

6A.6.3 During the spring when many farmers and growers are attempting to raise early crops, warnings of frost are of vital importance. A spring frost may destroy a crop or put it back so far that its value in cash terms is very greatly diminished. Given adequate warning measures can sometimes be taken to protect crops so particular attention should be paid to frost prediction.

6A.6.4 Strong winds (greater than about 20 knots) can cause "blows" in spring and summer when the soil is dry and crop cover is sparse. Areas particularly at risk include sandy soils (e.g. near the Moray coast) and peaty soils (e.g. East Anglia). Winds which increase markedly in strength or change direction during the day are also of importance in arable areas after harvesting when stubble is burnt. Because of the fire hazard, wind is always important in forecasts for stubble burning (see paragraph 6A.2.9).

(A.L.1)

Wind direction and strength is always an important consideration when crops are to be sprayed and when assessing the risk to be associated with volatile spray chemicals for a few days after they have been applied.

AGRICULTURAL CALENDAR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1. Seed bed preparation												
2. Manure spreading												
3a. Sowing cereals												
3b. Sowing roots												
4. Disease assessment												
5. Spraying												
6. Irrigation												
7. Harvest (various crops)												
8. Root harvest												
9. Silage making												
10. Hay making												
11. Opening clamps												
12. Turning out												
13. Supplementary feeding												
14. Lambing												
15. Horticulture												
16. Dessicating haulm												
17. Straw burning												
18. Protecting machinery												

PESTS AND DISEASES (EXCEPT FOOT AND MOUTH)**6C.1 Common diseases of cereals**

6C.1.1 Cereal diseases are generally caused by fungi in common with most infectious diseases of plants. Some of these are soil-borne and tend to spread only slowly within the field. Others are seed borne either as contaminants on the seed surface or as an infection within the seed. Some are spread by airborne spores. The last group, given favourable conditions, can spread quickly from field to field, sometimes over considerable distances.

6C.1.2 Barley mildew This is a serious fungal disease of the leaves; it spreads rapidly in early sown crops (e.g. in September when temperatures are still relatively high) and in spring as temperatures rise, further spread can occur. The development of barley mildew is favoured by warm dry weather.

6C.1.3 Brown rust This a serious disease of barley and is also common in wheat. Development is most rapid in warm wet conditions. Long-range spread is by airborne spores.

6C.1.4 Eyespot This is another fungal disease which affects both wheat and barley and, less commonly, oats and rye. The disease is most active in the wetter cooler months. Spread within the crop is mainly by rain splashed spores. The fungus weakens the stem causing the plant to fall over and the stem then rots.

6C.1.5 Net blotch This affects the leaves of barley. The main source of the disease is the straw and stubble of a previous crop. Spores are dispersed by rain splash and wind. Infection is favoured by wet or very humid conditions.

6C.1.6 Rhynchosporium (leaf blotch) This is a fungal disease affecting, principally, the leaves of barley but occasionally rye and some grasses. The disease is favoured by cool moist weather and spread is thought to be mainly by splashing.

6C.1.7 Septoria This (also known as leaf spot and glume blotch) is an important fungal disease of wheat; it is not important on barley. Spores are produced during periods of leaf wetness and high humidity; they are spread mainly in water drops, for example by splashing rain. They are also carried in smaller airborne droplets and hence the disease can spread from field to field. In coastal districts a combination of mists and wind can cause severe attacks. The disease affects the leaf and stem and can cause yield losses of 25-30%. The period at the end of May and early June is most critical for infection just before the ear emerges.

6C.1.8 Yellow rust This is a serious disease of wheat which also affects barley, rye and many grasses, but not oats. The disease affects the leaves. Cool wet conditions are required for spread. Long-range transport by airborne spores has been observed.

## 6C.2 Common diseases of non-cereal crops

6C.2.1 Alternaria (dark leaf spot) Affects oil seed rape and brassicas such as Brussels sprouts. Spread is favoured by warm wet conditions during flowering.

6C.2.2 Apple scab This is a fungal disease which infects trees during the spring from the time when flower buds are bursting. The infection causes blemishes on leaves and on the fruits which are later produced. The disease over-winters on leaves and other debris on the ground and the spores are released in spring by the impact of precipitation. Infection depends on a period of leaf wetness following precipitation characterized by a dew-point depression not greater than 1 °C. The critical length of the period of leaf wetness varies according to the mean dry-bulb temperature during the period.

6C.2.3 Botrytis This is a fungus that can affect most plant species. Under humid conditions infected tissues develop a growth of grey mould.

6C.2.4 Fire-blight This is a bacterial disease of apple, pear and related trees and shrubs such as hawthorn. Risk is greatest when the temperatures exceed 18 °C and there is rain. Blossom infection is particularly likely on warm sunny days when insect activity is high. Heavy storms increase the risk of shoot infection. ADAS has developed a complex weather-based risk assessment scheme.

6C.2.5 Light leaf spot This also affects oil seed rape and brassicas. During wet weather spores are splashed up the plant to infect top leaves and pods. Wet weather assists development.

6C.2.6 Potato blight Potato blight is a fungal disease which affects leaves and tubers of the potato plant. Infection of the leaves impairs the photosynthetic efficiency of the plant and so decreases the amount of dry matter produced in the leaves for storage in the tubers, thus reducing the crop yield. Spores washed from the leaves into the soil can infect tubers and reduce the quality of the crop. Infection can spread inside clamps and stores so that keeping properties of the crop can also be affected. The weather is one of the factors which determine the incidence of potato blight; mild moist conditions are favourable for development. In the light of weather and crop information plant pathologists can advise farmers of the need to apply sprays to slow the spread of the disease.

6C.2.7 Potato blight weather information is required daily during the period from 1st May to 30th September. The "Smith Period" is a well-known index of the disease. It is a period of at least two consecutive days when the minimum temperature is 10 °C or above and on every day there are at least 11 hours when the relative humidity is 90% or more. (A "near miss" occurs when one or both of the two days has only 10 hours of high relative humidity.) Weather such as this is suitable for the development of the disease and occurrences of Smith Periods are often used to determine the timing and frequency of spraying. A more complex scheme has been developed which involves extracting for each 24-hour period 1000-0900 GMT hourly values of air temperature, dew-point and present weather and calculating, using a computer model, the likelihood of disease development. Neither of these indices is useful for crops that are irrigated or that are initially grown under plastic - practices that are now common.

(A.L.1)

6C.2.8 Ring spot This is a widespread problem in brassicas. This disease causes circular lesions on leaves which often subsequently become invaded by bacteria which cause rotting. Spread is by airborne spores during warm humid conditions.

### 6C.3 Plant pests

6C.3.1 The rate of development of egg and larval stages of insects is controlled mainly by temperature. Daily values of temperature from synoptic stations combined with 3-day forecasts of temperature allow estimates to be made of development to critical stages and enables advisory entomologists to issue timely warnings of the need for spray treatments.

6C.3.2 Pea moth The newly emerged adult moths fly to the new pea crops, usually around early June, to lay their eggs. This migration is monitored using traps. When catches indicate that the moth population has reached a significant level, egg development is estimated from daily temperatures. Advice is given so that pesticide is present on the plant when larvae emerge so as to kill them before they infest the newly formed pods.

6C.3.3 Cut worms (larvae of turnip moth) Emergence of adult moths, in late May or early June, is monitored using traps, and progress through egg and first two larval stages is estimated from daily observed and forecast temperatures. Young larvae may be washed off the foliage by rainfall and, being unable to regain a food supply, will die. The need to spray is indicated by the estimated survival of larvae and treatments are advised before the larvae develop to a stage when they move from foliage to the soil and cannot be reached by pesticide treatments.

### 6C.4 Common diseases in livestock

6C.4.1 Forecasts and advice on the likely incidence and intensity of a number of diseases in livestock are issued as required by the Central Veterinary Laboratory, Weybridge, in collaboration with the Office.

6C.4.2 Swayback This is a nervous disorder in lambs associated both with low levels of copper in the ewe and the ewe's ingestion of soil which inhibits the metabolization of copper. Development of the disorder is favoured by mild, snow-free winters probably because the ordinary diet is not then supplemented with hay.

6C.4.3 Nematodiriasis This is a worm disease of lambs, high incidence being favoured by cold winters and late springs when worm emergence on the pasture coincides with the onset of grazing.

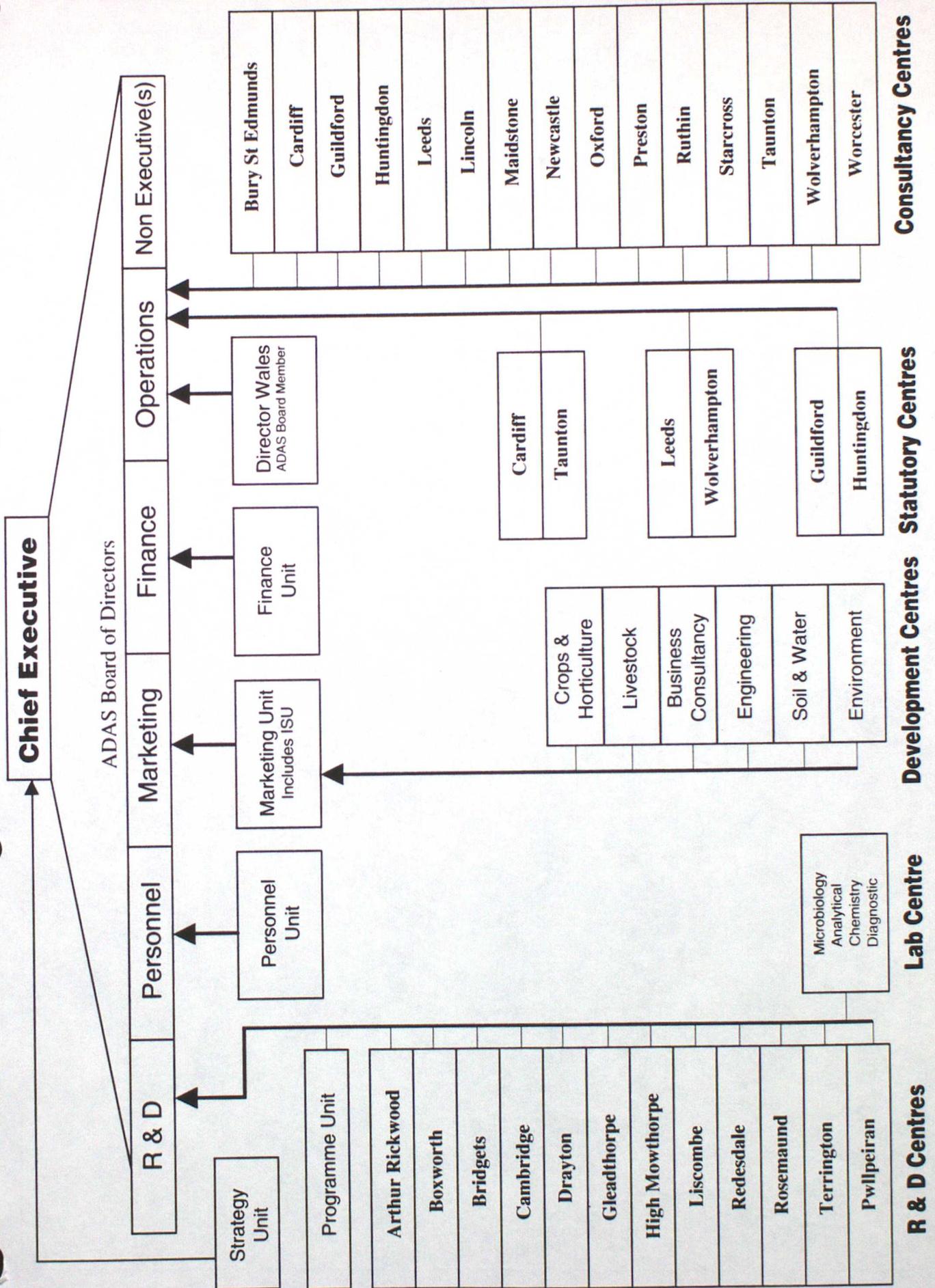
6C.4.4 Liver fluke disease (Facioliasis) This is a parasitic disease associated with wet summers which encourage the survival both of the worm and of its host snail. Forecasts of likely spring severity can be issued the previous August by the Central Veterinary Laboratory.

6C.4.5 Parasitic gastro-enteritis (Ostertagiasis) This is a worm-induced disease in which early, severe incidence seems associated with warm wet summers.

6C.4.6 Newcastle disease (fowl pest) A virus disease of hens and turkeys which can cause high mortality in young birds and reduced productivity in older stock. The virus can be transmitted by airborne spread and a warning system similar to FMD can be used to find out where outbreaks will occur from an initial focus.

6C.4.7 Foot and mouth disease Please see Annex F.

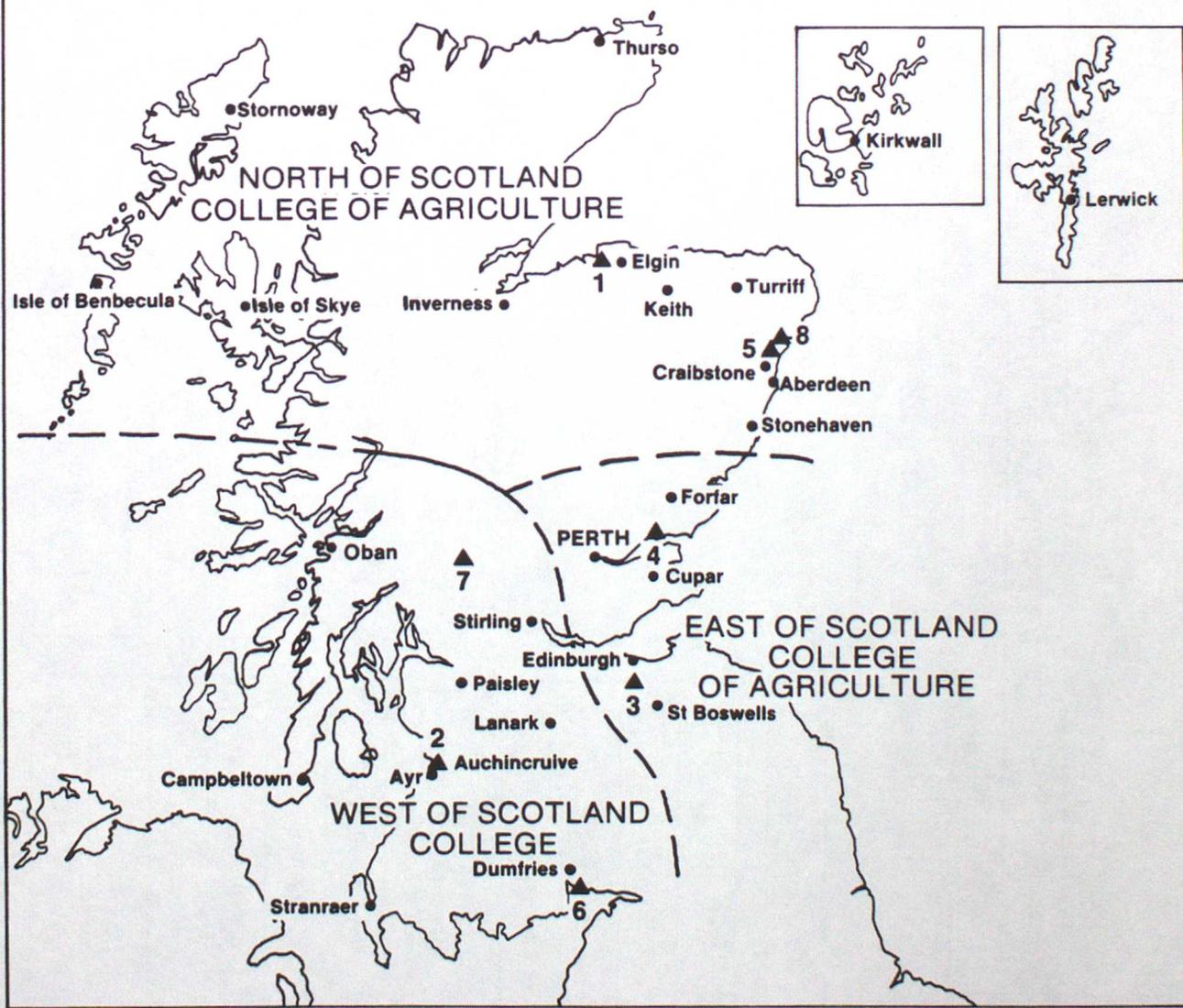
6C.4.8 Swine vesicular disease Please see Annex F.



ORGANIZATION OF THE SCOTTISH AGRICULTURAL COLLEGE

KEY TO LIST			KEY TO MAP
Advisory office ■	SAC H.Q. □	Veterinary centre ○	College farms ▲

Ayr ■	Inverness ■ ○	Perth ■ □ ○	1. Aldrougthy ▲
Auchincruive ■ ○	Isle of Benbecula ■	St Boswells ■ ○	2. Auchincruive ▲
Campbeltown ■	Isle of Skye ■	Stirling ■	3. Bush estate ▲ (8 farms)
Craibstone ■ ○	Keith ■	Stonehaven ■	4. Castle Huntly ▲
Cupar ■	Kirkwall ■	Stornoway ■	5. Craibstone ▲
Dumfries ■ ○	Lanark ■	Stranraer ■	6. Crichton ▲
Edinburgh ■ ○	Lerwick ■	Thurso ■ ○	7. Kirkton- Auchtertyre ▲
Elgin ■	Oban ■	Turriff ■	8. Tillycorthie ▲
Forfar ■	Paisley ■		



## LAMB WIND-CHILL FORECASTS

**6E.1 Procedure**

6E.1.1 The forecasts depend on three parameters: temperature, wind speed and rain/no rain. The standard service comprises one forecast issue per day, with the 24-hour period divided into 6, 4-hour periods.

6E.1.2 The mean temperature and mean wind speed are forecast for each 4-hour period and the stress value taken from the appropriate table, Appendix A. The vital factor is the rain/no rain parameter. This is particularly difficult when the weather is showery or where only light drizzle is expected. In these cases the following guidelines should be followed:

- a. Where showers are expected to be light and/or infrequent, use Table I (DRY) in Appendix A.
- b. Where long periods of light drizzle are expected even when the relative humidity is expected to remain high (>90%) then bias the figure in favour of Table I (DRY) in Appendix A. This is due to the fact that under these conditions the insulation property of the coat remains similar to that when completely dry.
- c. Where heavy or frequent showers are expected during a forecast period then factors are allocated from both Tables I (DRY) and II (WET) to give the resulting range for the customer.

6E.1.3 The factors for each 4-hour period should be summed and the resulting index passed to the customer. For guidance the following thresholds apply:

- a. For good size (usually single) lambs:

Below 80	No danger
80-90	Warning
90-94	Danger
Above 94	Critical

- b. For weaker (twins and triplets) lambs:

Below 70	Little danger
70-79	Warning
80-90	Danger
Above 90	Critical

**6E.2 Administration**

6E.2.1 Each customer should provide: location, telephone contact number, mean height of farm (range of heights if significant), start and approximate stop dates and time he will call for data. (The charge quoted assumes that the customer will initiate the routine daily call.)

6E.2.2 Customers can be grouped together if all the factors in section 2.1 permit. This may reduce the number of issues required.

6E.2.3 Copies of Agricultural Memoranda Nos. 934, 949 and 989 should be available for background information (obtainable from NAMO or through Headquarters).

TABLES OF LAMB WIND-CHILL

TABLE I (DRY)

WIND (KT)	TEMP (T) (°C)	$T > 0$	$0 \geq T \geq -5$	$T < -5$
> 20		12	13	15
10-20		11	12	13
< 10		10	11	12

TABLE II (WET)

WIND (KT)	TEMP (T) (°C)	$T > 5$	$5 \geq T > -0$	$0 \geq T \geq -5$	$T < -5$
> 20		17	18	19	20
10-20		16	17	18	19
< 10		14	15	16	17

**PROFORMA FOR LAMB WIND-CHILL FORECASTS**

Date.....

Forecast 'Wind-chill' Stress Factors for Newborn Lambs at .....

March/ April/ May 19....

Period LCT	0800 to 1200	1200 to 1600	1600 to 2000	2000 to 2400	0001 to 0400	0400 to 0800	TOTAL
Forecast Temp (°C)							
Forecast Wind Speed (KT)							
Rain?							
Forecast Stress Factor (see Annex A)							

Stress Factor(s) issued.....

Passed to .....

Time .....

Prepared by .....

Issued by .....

FOOT AND MOUTH DISEASE6F.1 Background information

6F.1.1 FMD is one of a group of vesicular (blister) diseases affecting cloven-hoofed animals (cattle, pigs, sheep, goats, etc.) and its potential effect on the agricultural economy is so important that any vesicular disease is assumed to be FMD unless proven otherwise. Swine vesicular disease for example is clinically indistinguishable from FMD in pigs and a biopsy must be taken to confirm which disease is present.

6F.1.2 There are seven types of FMD and a large number of strains of each. Recovery from one type or from a particular strain does not give immunity from infection by other types or even from different strains of the same type. Recovered animals can carry the disease at the back of their throats for a considerable time; up to three years in buffalo. Vaccinated animals can also carry the disease. The United Kingdom chooses not to vaccinate to avoid the possibility of unknowingly exporting the disease.

6F.1.3 The disease's most likely entry point into the animal is the back of the throat, but it rapidly spreads to other tissues. It manifests itself on the skin but affects the whole body so that even though breath produces most virus for infecting other animals, blood, semen, urine and faeces are all means of producing virus before any clinical signs are evident. For reasons as yet unknown, pigs produce many times more virus than any other infected animal but because cows cycle more air in breathing they are at most risk from airborne infection.

6F.1.4 Dead young animals are often the first sign of an outbreak because the disease quickly affects the heart muscles. Adult animals usually recover quickly, but lactation often stops, breeding suffers and heart disease becomes more likely. Thus it is the loss of economic output from the animal that is likely to be most serious for the farmer, but indirect losses to the country far outweigh those directly attributable to FMD - overseas markets tend to boycott anything from an infected area.

6F.1.5 The most important means of spread of the disease is by contact with infected animals, followed by infected products and farmhands/lorries exposed to infected animal. These methods of spread are all controllable. However, there is sufficient circumstantial evidence to convince scientists that the airborne carriage of virus is also a significant mechanism of disease spread and this is an area in which the Meteorological Office can play a significant role.

METEOROLOGICAL ADVICE IN OUTBREAKS OF FOOT AND MOUTH DISEASE  
IN FARM ANIMALS IN THE UNITED KINGDOM

Areas of responsibility of Meteorological Offices

6G.1	<u>Area (Regions or Counties)</u>	<u>M Met O</u>
6G.1.1	Scotland	Glasgow WC
6G.1.2	Northumberland, Tyne and Wear, Durham, Cleveland, Cumbria, North Yorkshire, West Yorkshire, Humberside, South Yorkshire, Derbyshire, Nottinghamshire, Leicestershire, Northamptonshire, Lincolnshire.	Leeds WC
6G.1.3	Norfolk, Cambridgeshire, Suffolk, Bedfordshire, Hertfordshire, Essex, Greater London, Surrey, Kent, Buckinghamshire, Oxfordshire, Berkshire, East Sussex, West Sussex, Hampshire, Dorset, Isle of Wight.	London WC
6G.1.4	Gwynedd, Powys, Dyfed, West, Mid and South Glamorgan, Gwent, Gloucestershire, Avon, Wiltshire, Somerset, Devon, Cornwall.	Cardiff WC
6G.1.5	Lancashire, Merseyside, Greater Manchester, Cheshire, Staffordshire, Clwyd, West Midlands, Hereford and Worcester, Warwickshire, Shropshire.	Manchester WC
6G.1.6	Northern Ireland.	Belfast M Met O

ACRONYMS USED WITH RESPECT TO AGRICULTURE, HORTICULTURE AND FORESTRY

ADAS Agricultural Development and Advisory Service  
DANI Department of Agriculture Northern Ireland  
MAFF Ministry of Agriculture, Fisheries and Food  
MSM(A) Agriculture Market Sector Manager  
NAMO National Agrometeorological Officer  
NAMU National Agrometeorological Unit  
PSP Production and Service Provision  
SCA Scottish Colleges of Agriculture  
WOAD Welsh Office Agriculture Department

## WORKING CRITERIA WHEN PREPARING ACTIVITY FORECASTS FOR FARMCALL

### WEATHER HEADLINE

Brief description of the main weather events during the forecast period, which is 5 days. Some meteorological terminology can be used such as highs, lows fronts, etc.

### WEATHER HEADLINE — EXAMPLES

1. Areas of low pressure will stay close to the country with the weather staying changeable. However, there is a good chance of fine weather later in the week as the pressure rises.
2. A cold northerly wind will persist with widespread hard frost and snow showers especially near to the coast. Later in the week, the wind will turn more westerly and the weather will become milder with some rain.
3. The hot and dry spell will continue with a lot of sunshine. Later in the week and over the weekend, low pressure will drift up from France increasing the risk of thundery showers.
4. A depression over the North Sea will move away into the continent and a temporary ridge of high pressure will bring a day or two of fine weather. However, further Atlantic lows will bring rain and wind over the weekend.
5. A large area of high pressure will remain close to the country with the dry weather persisting for several days.
6. The very wet spell will continue with further wind and rain. However, rising pressure should improve things by early next week.
7. The severe wintry weather will continue for some time with strong easterly wind and further snow.
8. A dry but strong north-easterly wind will persist for a few more days but as an anticyclone drifts slowly south so the wind should become lighter.
9. A ridge of high pressure will persist today with the weather remaining fine. However, a warm front will approach from the west tonight heralding a change to much more unsettled conditions.

### 6J.1 Crop spraying

#### 6J.1.1 Wind

**Force 1 or below** — not suitable for crop spraying as air movement is unpredictable especially on hot days and can move volatilized chemicals to nearby crops. (Volatized = change state from liquid to vapour)

**Force 2** — ideal for all crop spraying.

**Force 3** — avoid spraying herbicides, other spraying activities OK.

**Force 4 or above** — all spraying inadvisable.

*Notes:* Wind directions in 8-point compass. Give general direction for period but emphasize **days when the wind is going to very variable and also indicate likelihood of sea-breezes in coastal areas.**

6J.1.2 Rainfall Indicate likelihood of at least 5 hours dry weather ( dawn to dusk ). **5 hours** is considered the usual length of time required to spray an average field and for the chemicals to act before before it rains.

6J.1.3 Temperature Advise on high temperatures **in excess of 21 °C** and also low temperatures **0 °C or below**. Both these conditions can cause scorching of crops by the chemicals and/or reduce the efficiency of some chemicals. On hot days, farmers may choose to spray in the evenings. However, on days when the temperature falls quickly in the evening, i.e. very low dew-point air, this temperature drop can cause a few problems so **advise that the evening will quickly become cool.**

6J.1.4 Sunshine Advise only if there will be **strong** sunshine, i.e. good clear periods with little or no cloud and/or haze.

## **CROP SPRAYING — EXAMPLES**

1. The westerly wind today will remain over force 4 and with frequent showers, conditions will not be suitable. However, Wednesday and Thursday will be much less windy and it will also be dry. At the end of the week, further rain and wind is expected.

2. Although the wind will start off light, a freshening south-easterly is expected this afternoon reaching force 4 and rain is also expected by evening. The best conditions are therefore likely during the morning. The rest of the week will be unsettled and often windy.

3. Today will be dry throughout with a light easterly wind. However, the wind will be over force 3 at times this afternoon so take care if you are spraying herbicides. After a dry start, tomorrow will become wet and windy and there is little chance of suitable weather before the end of the week.

4. With just a light westerly wind around force 2, and a dry day, conditions are good for spraying today. However, watch out for a force 3 or 4 sea-breeze near the coast this afternoon and the sun everywhere will be strong and virtually unbroken. The outlook for the following 4 days is for more ideal conditions but with a risk of thundery showers by Friday.

5. Although the wind will be mainly a light, force 3, southerly there will be stronger gusts near showers. Showers will be scattered but there is only a small chance of a dry period of five hours. Little change is expected during the following 4 days with further showers weather.

6. Today will be very warm and dry with strong sunshine, the temperature up to 2 degrees this afternoon so some scorching is possible. The evening will also be dry but the temperature will fall quickly with the easterly wind increasing to force 4. The following 4 days will be mainly dry but with a fresh northeasterly wind especially near the coast.

7. Although dry, today will become hot with the temperature over 25 degrees combined with strong sunshine so the best conditions will be early and again later. However, the wind will be light and often very variable in direction so care must be taken when spraying. Conditions look fairly good during the rest of the weekend and early next week.

8. Conditions will be good this morning with a light force 2 or 3 southerly wind and about 5 hours of dry weather. However, rain is expected after midday and it will be heavy at times. Tomorrow will have too much wind for spraying but improving conditions are expected after that.

9. The next three days will be very showery and windy with some longer spells of heavy rain. However, by Thursday, conditions will be more suitable with a lighter wind and a good chance of at least 5 hours dry weather.

## **6J.2 Fertilizer application**

6J.2.1 Soil conditions Advise of **precipitation** and/or **frost** as ground conditions are important for successful application. **Prolonged periods of precipitation** should also be highlighted as should **prolonged periods of dry weather**. The latter may cause the fertilizer to scorch the plants before it gets washed into the soil.

6J.2.2 Wind speed Advise of winds of Force 4 and above as these may distort the fertilizer pattern.

Ideally fertilizers should be applied in dry and warm conditions (for the time of year) but with some rain (1 to 5 mm) within 3 or 4 days of application. Prolonged periods of dry weather will cause the fertilizer to scorch plants before it gets absorbed into the soil.

Prolonged wet periods (especially if the ground is wet already) will cause the fertilizer to be washed straight through or off the soil (leached) before plants take it up.

The hard ground associated with frosty weather will prevent fertilizer getting into the soil and it also causes plants to stop working. This prevents plants absorbing the nutrients that are in the soil.

In the summer months, farmers can substitute irrigation for rain if application is necessary and soil/temperature/wind conditions are otherwise good.

### FERTILIZER APPLICATION — EXAMPLES

1. Today along with the following 4 days will be mainly dry, just the chance of a few light showers on Sunday. As a result, conditions are generally good for fertilizer application. and the wind will be less than force 4 for most of the time.
2. Further heavy showers or longer spells of wet weather are expected both today and on Saturday. However, the second half of the weekend should see improving fertilizer application conditions with a light wind and no more than a few showers.
3. Although mainly dry for the next two days, the westerly wind will often be strong, that is above force 4. Later in the week, the risk of heavy showers becomes greater.
4. The long, hot and dry spell looks like continuing throughout the next 2 or 3 days so there must be a risk of fertilizer scorching your plants. The wind will also be gusty in the afternoons and this may distort the fertilizer pattern. Towards the end of the week, the weather is likely to turn cooler with showers.
5. The weather will remain very unsettled during the remainder of the week with further periods of rain or showers. Fertilizer application will also be hindered by a strong west to south-westerly wind.

### 6J.3 Cultivations

6J.3.1 Rain and Wind Advise on likelihood of ground becoming **wetter or drier**, i.e. advise on likelihood of good drying conditions, i.e. **wind combined with warm weather and/or low dew-point air.**

or poor drying conditions, i.e. **rainfall greater than average evaporation and/or high humidity, light wind speeds.**

*Note:* The Table overleaf indicates the average evaporation per day for each area. The second row is the standard deviation, i.e. the amount to add for a very dry day or the amount to subtract for a wet and humid day. Clearly the figures are very approximate but they can nevertheless be used as a guide to ascertain if the ground is likely to become wetter or drier. For example, if you are expecting about 10 mm of rain over the next five days in July in area 10, the ground is unlikely to become drier as the evaporation will be only around 5 mm (approx. 1 mm per day).

Advise on heavy rainfall which may cause compaction or erosion of soil.

6J.3.2 High wind speeds (force 6 or above) Area 13 only — advise of such wind speeds (mean speeds) which may cause soil blows during dry periods. Indicate direction also.

6J.3.3 Ground Frost Periods of ground frost lasting throughout the day should be indicated since these may prevent the farm machinery doing the job.

### CULTIVATIONS — EXAMPLE

1. Ground conditions will continue to improve during the next 2 or 3 days with only a few showers and a good drying wind. However, rainfall amounts are expected to increase over the weekend.
2. With further heavy showers both today and on Tuesday, the ground will if anything get a bit wetter. However, less rain is expected towards the end of the week and with a dry northerly wind, cultivating conditions should improve although the weather will be very cold.
3. Although rainfall amounts will be small during the coming week, it will often be misty and humid so the ground will dry only slowly following all the rain last week.
4. The generally unsettled weather will persist with a mixture of rain or showers and the ground will probably remain more or less as it is now.

The following table contains the mean daily actual evaporation figures for stations in the Weathercall areas.

The figure in the upper row is the actual figure of evaporation and the figure in the lower row is the correction to be allowed for

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DCNN WCALL													
5331	402	0.3 0.1	0.4 0.1	0.8 0.2	1.1 0.2	1.4 0.5	1.3 0.5	1.2 0.5	1.3 0.4	1.0 0.3	0.7 0.2	0.4 0.1	0.3 0.1
5603	403	0.3 0.1	0.5 0.1	0.9 0.1	1.2 0.2	1.5 0.4	1.3 0.5	1.1 0.5	1.4 0.5	1.1 0.3	0.7 0.2	0.5 0.1	0.3 0.1
8811	404	0.4 0.1	0.6 0.1	0.9 0.1	1.3 0.3	1.5 0.4	1.3 0.5	1.4 0.4	1.5 0.4	1.2 0.3	0.9 0.2	0.6 0.1	0.4 0.1
5848	405	0.3 0.1	0.5 0.1	0.8 0.1	1.1 0.2	1.5 0.4	1.3 0.5	1.3 0.5	1.4 0.4	1.1 0.3	0.7 0.1	0.5 0.1	0.3 0.1
4522	406	0.3 0.1	0.5 0.1	0.8 0.1	1.2 0.3	1.5 0.4	1.4 0.5	1.3 0.6	1.4 0.5	1.1 0.3	0.7 0.2	0.5 0.1	0.3 0.1
3644	407	0.3 0.1	0.4 0.1	0.8 0.2	1.1 0.2	1.3 0.4	1.2 0.5	1.1 0.5	1.2 0.4	0.9 0.4	0.7 0.2	0.4 0.1	0.3 0.1
3031	408	0.3 0.1	0.4 0.1	0.7 0.1	1.1 0.2	1.4 0.4	1.3 0.5	1.3 0.4	1.3 0.5	1.0 0.3	0.7 0.4	0.4 0.1	0.2 0.1
8585	409	0.3 0.1	0.4 0.1	0.8 0.1	1.1 0.2	1.5 0.3	1.4 0.4	1.3 0.4	1.5 0.4	1.1 0.3	0.7 0.1	0.4 0.1	0.2 0.1
4886	410	0.3 0.1	0.4 0.1	0.8 0.2	1.1 0.2	1.5 0.3	1.3 0.4	1.2 0.5	1.4 0.5	1.0 0.3	0.7 0.1	0.5 0.1	0.3 0.1
4447	411	0.3 0.1	0.5 0.1	0.9 0.2	1.2 0.3	1.5 0.4	1.4 0.5	1.2 0.5	1.5 0.5	1.1 0.4	0.7 0.2	0.5 0.1	0.3 0.1
4201	412	0.4 0.2	0.5 0.1	0.9 0.2	1.2 0.3	1.3 0.3	1.3 0.6	1.3 0.4	1.5 0.5	1.1 0.3	0.8 0.2	0.5 0.1	0.4 0.1
2432	413	0.2 0.1	0.4 0.1	0.8 0.2	1.1 0.2	1.3 0.4	1.3 0.6	1.2 0.4	1.4 0.4	0.9 0.3	0.7 0.2	0.4 0.1	0.3 0.1
8086	414	0.3 0.1	0.4 0.1	0.7 0.1	1.1 0.2	1.5 0.3	1.6 0.3	1.6 0.4	1.5 0.4	1.1 0.2	0.8 0.2	0.5 0.1	0.3 0.1
7748	415	0.5 0.1	0.6 0.1	0.9 0.1	1.3 0.2	1.6 0.3	1.6 0.3	1.5 0.4	1.6 0.4	1.4 0.2	1.0 0.2	0.6 0.1	0.4 0.1
5113	416	0.3 0.1	0.5 0.1	0.9 0.1	1.2 0.2	1.4 0.5	1.3 0.6	1.2 0.6	1.3 0.5	1.0 0.4	0.7 0.3	0.5 0.1	0.3 0.1
4045	417	0.3 0.1	0.4 0.1	0.8 0.2	1.2 0.2	1.5 0.4	1.5 0.5	1.4 0.4	1.6 0.4	1.2 0.3	0.8 0.2	0.5 0.1	0.3 0.1
2165	418	0.3 0.1	0.4 0.2	0.7 0.1	1.2 0.2	1.3 0.3	1.4 0.4	1.3 0.3	1.4 0.4	1.1 0.2	0.7 0.1	0.4 0.1	0.3 0.1
7071	419	0.3 0.1	0.4 0.1	0.8 0.1	1.1 0.2	1.5 0.3	1.5 0.4	1.6 0.3	1.5 0.4	1.2 0.2	0.7 0.1	0.4 0.1	0.3 0.1

5. The hot and dry weather will persist for much of the week with very good drying conditions. However, keep in touch because there is a risk of thundery showers at the weekend.
6. Although a few very heavy and thundery showers are expected on Thursday and Friday, with high temperatures and a brisk wind, the ground should generally become a bit drier. During the weekend and early next week, the weather will become mainly dry but cooler.
7. With a light wind and mainly dry weather, the ground will become a bit drier during the next 5 days. However, overnight frost will last well into the morning.
8. The dry weather will persist all week in Lincolnshire and Humberside. However, the north-westerly wind will be very strong and gusty both today and on Friday so there is a risk of soil blowing.

#### 6J.4 Combine harvesting

6J.4.1 Rainfall Principal emphasis at harvesting is on periods of **dry weather** especially when combined with low humidities. Advise therefore on wet or dry spells **and also** when a **heavy dew is expected**.

6J.4.2 Humidity Advise on likely relative humidity **during the day**, i.e. **high, medium or low**.

6J.4.3 Wind Advise of **force 5 or above** as fresh/strong winds can blow straw over adjacent houses or other farmer's fields.

Also when catchword is

#### LINSEED

6J.4.4 Sunshine Linseed is almost impossible to harvest when the sun is not actually shining. Farmers will appreciate notification of **temperature** together with **projected cloud cover and levels of relative humidity**.

**High humidity** affects the straw of this crop; **clear skies and/or very little cloud** means good linseed combining weather.

#### OILSEED RAPE

6J.4.5 Gale force winds Force 8 winds can rip through crops and blow out seed pods.

#### COMBINE HARVESTING — EXAMPLES

1. Although the weather will become humid with heavy dew in the morning, the dry conditions will persist and with high temperatures in the afternoon and evening, harvesting conditions during the latter half of the days will be good.
2. The unsettled weather will give way to much drier conditions after the weekend with lower humidities so harvesting conditions will improve.
3. The next 5 days will be ideal for harvesting with low humidity and plenty of sunshine.
4. The westerly wind today will be over force 5 at times so take care when harvesting near adjacent property. However, conditions will stay generally dry both today and on Thursday so **harvesting conditions will remain good**. Later in the week and over the weekend there is an increasing risk of showers or longer periods of rain

#### CATCHWORD — LINSEED

5. The next few days will be mainly dry although later in the week rain is expected to spread from the west. Therefore, harvesting conditions will be good to start off with but with very little sunshine both today and on Tuesday, there may be problems if you are harvesting linseed.
6. Harvesting conditions will stay very good with clear skies and low humidities, the temperature this afternoon up to 24 degrees. Similar weather is likely on Wednesday but a change to cloudier skies is expected after that so conditions won't be as good for linseed harvesting.

## 6J.5 Forage harvesting

When catchword is;

### HAYMAKING

6J.5.1 Rainfall weather needs to be dry for 4 or 5 days; wet ground should dry out before grass is cut. Advise also of heavy dew especially when low cloud/fog delays the sun coming out.

6J.5.2 Wind speed advise also of winds of **force 3 or above**.

### SILAGE

6J.5.3 Rainfall requirement is 24 to 36 hours of dry weather to allow grass to wilt following cutting.

### FORAGE HARVESTING — EXAMPLES

#### CATCHWORD — HAYMAKING (Mention at least once)

1. Conditions will be very good for haymaking this weekend and early next week with dry and sunny weather.
2. The weather will stay windy and changeable with some heavy rain so current conditions are unsuitable for haymaking.
3. Good haymaking conditions will persist for the next two days with dry weather and low humidities. However it will become windy during the afternoons with a force 4 or 5 easterly. The weekend looks much less suitable with a change to wet and windy conditions.
4. Today will still be showery but the next few days will see a change to much drier weather with low humidities so the grass should dry quite well with haymaking possible later.
5. Although there will be a heavy dew to start the day with mist and fog this morning, the afternoon will become warm and sunny. Similar haymaking conditions are expected over the weekend and early next week.

#### CATCHWORD — SILAGE (Mention at least once)

1. Conditions are good for making silage today and tomorrow with dry weather persisting. Things look less certain later in the week with an increasing risk of showers.
2. Showers are expected today some of which will be heavy so there are no suitable conditions for silage making just yet. The end of the week looks similar with further rain or showers.
3. Dry weather is expected to last for at least the next 4 or 5 days with good silage making conditions.

## 6J.6 Root crop harvesting

Advise of periods of prolonged rainfall or frost. This applies mainly to potatoes and sugar beet but will apply to the vegetables in the January to April period.

Ideally, the ground should be moist but not soggy. Very dry ground that can occur when harvesting in late summer is very bad since machines cannot differentiate clods from potatoes! An onset of rainy conditions is usually most welcome under these circumstances. Harvested crops are usually kept in piles known as clamps at the side of the fields. In frosty weather, clamps need to be covered by sacks or straw. In mild and humid conditions they must be uncovered to prevent sweating and rotting. The greater the weather extreme, the greater the problem.

### ROOT CROP HARVESTING — EXAMPLES

1. No prolonged periods of rainfall or frost are expected during the next five days.
2. The weather will remain dry but very cold with hard frost night and morning.

3. The next five days will remain very unsettled with heavy showers or longer spells of heavy rain at times.

## 6J.7 Sheep

When the catchword is;

### LAMBING

Wind-chill Advise on **wind-chill factor** and describe conditions causing this, i.e. strong winds combined with **rain and snow plus low temperatures**.

### SHEARING and DIPPING

Precipitation Advise on prolonged wet weather or frequent heavy showers. Such conditions affect the concentration of the dip.

### SHEEP — EXAMPLES

#### CATCHWORD LAMBING

Wind chill can kill new-born lambs. Many lambs are born under cover, protected from the elements. However, farmers often only have undercover space for a fraction of the flock and so it has to be managed well, with makeshift outdoor structures erected if need be.

Wind chill is governed by temperature, wind speed, and precipitation duration and intensity. Drizzle and light rain or showers do not have a chilling effect.

- Danger conditions —
- Mainly dry  
Temperature below  $-5^{\circ}\text{C}$  all day  
Wind force 5 or more all day
  - 4–8 hours of rain or frequent showers  
Day maximum below  $5^{\circ}\text{C}$ , night minimum below  $0^{\circ}\text{C}$   
Wind force 4 or above all day
  - 8–12 hours of rain or frequent showers  
Minimum temperature below  $0^{\circ}\text{C}$   
Wind force 4 or more when wet
  - More than 12 hours of rain or showers  
Minimum temperature between 0 and  $5^{\circ}\text{C}$   
Wind force 3 or more when wet

These guidelines should be used intelligently and not with absolute rigidity. For instance twins and triplets will suffer in conditions a little less severe than those given above. The crucial parameter is the duration of wet weather without drying periods in between.

#### CATCHWORD SHEARING and DIPPING

1. Although dry today the weather will turn wetter over the following 4 days with some heavy showers at times.
2. A few showers are likely over the next few days but on the whole, conditions will be good for sheep shearing and dipping.
3. Thundery showers this afternoon could well give localized very heavy downpours which may affect the concentration of sheep dip. However, the weather over the following few days is expected to be mainly fine and warm.

## 6J.8 Cattle

6J.8.1 Thunder Advise on risk if there is one, i.e. high, medium or low

6J.8.2 Rainfall and general weather In Spring and Autumn advise if any sudden change in the weather is likely to last or is just a blip with things returning to normal soon. The sponsors are aware that we cannot forecast long periods ahead with any degree of confidence, i.e. a month ahead but would nevertheless like us to give a 5 days trend when the weather is currently unseasonable, e.g. warm, cold.

#### **CATTLE — EXAMPLES**

1. Although some showers are expected during the next days, they will be mostly light with only a low risk of thunder.
2. Showers this afternoon could well be heavy with thunder. However, the following 4 days will be mainly fine.
3. The rest of the week will be mainly dry with only a few showers, mainly on Thursday. The thunder risk is low.
4. The current very warm spell is certainly exceptional for April but although the weekend will see little change, the weather is likely to turn more unsettled and much cooler on Monday.

#### **HOUSED ANIMAL MANAGEMENT**

**At all times when the air temperature will be 23 °C or above for 3 or more hours during either or both of the first 2 days.**

Advise of above giving **maximum** temperature plus indication of how **humid and/or windy** it will be. This is to alert livestock farmers of possible heat stress in housed stock.

#### **HOUSED ANIMAL MANAGEMENT — EXAMPLES**

**These messages are issued at any time, i.e. we do not get a prompt from John Kendall Associates.**

1. The afternoon temperature today will reach 27 degrees Celsius and with only a light breeze it will feel humid. Wednesday will be a little cooler, the temperature up to 24 degrees and the wind will also be more noticeable.
2. The temperature tomorrow, that is Friday, will be much higher than on recent days reaching 25 degrees in the afternoon but the humidity will be low with a force 4 north-easterly breeze.