



# Irrigation Advisory Services and Participatory Extension in Irrigation Management

Workshop organised by  
FAO – ICID

IRRIGATION ADVISORY SERVICES:  
EXPERIENCES IN THE UK

by

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24 July 2002

Montreal, Canada

# Irrigation advisory services: experiences in the UK

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## ABSTRACT

Although agricultural irrigation accounts for <2% of total water abstractions in England and Wales, it is a consumptive use, concentrated in the driest areas and in the driest months, and hence places high demands on water resources at times when water resources are at their lowest. Historically, irrigation advice was provided free to farmers and growers as part of the national strategy to boost agricultural production after the Second World War. However, in the 1990s this service was privatised and now all irrigation advice is provided commercially by consultants, suppliers and researchers. In many cases, irrigation advice is provided as part of a general agronomy package, but in others it is a specialised service. Irrigation scheduling advice is available based on water balances or in-field measurements of soil water, although current estimates suggest that less than 1 in 6 irrigating farmers make use of a commercial service and about half the irrigated area is not scheduled in any “scientific” manner. Changes in European water resources policy and national legislation are likely to increase pressure on farmers and growers to demonstrate ‘wise use of water’ and the commercial advisory services will have a significant role to play.

## INTRODUCTION

### Irrigation in the UK

Agricultural production in the UK is predominantly rain-fed. However, significant volumes of water are used for irrigation to supplement rainfall on some crops in dry summers and in the drier regions of the country. Since 1969, the total area irrigated in a dry year has more than doubled, and the total volume of water applied more than tripled. In 1995, the most recent dry year in irrigation terms, it was reported that 162 690 m<sup>3</sup> of water were applied to a total irrigated area of about 156 340 ha (England only) (MAFF, 1997). Potatoes, vegetables and sugar beet currently represent the most important irrigated crops.

Nationally, irrigation constitutes only a small use of water, accounting for <2% of total abstractions. It is, however, a consumptive use, concentrated in the driest areas and in the driest months, and hence places exceptionally high demands on water resources at times of the year when flows are at their lowest. Most irrigation water is abstracted from rivers and streams, and used directly, with relatively little on-farm storage (Knox *et al.*, 1997). As a result, there is now widespread pressure on many surface and groundwater resources, striving to meet the increasing and competing demands for public water supply, industry and agricultural irrigation. The droughts in 1988-92 and more recently in 1995-96 have highlighted the fragile balance that exists between the competing needs of public water supply and agriculture with those of the environment (DETR, 1998).

In response to these concerns, a number of changes in how the water environment is managed is being implemented by the UK government. These primarily relate to the abstraction licensing system (all spray irrigation abstractions require a licence) and the development of river basin plans or catchment abstraction management strategies (CAMS). Both actions are largely in

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response to meeting requirements of European legislation, notably the Water Framework Directive (2000/60/EC). It is apparent that increased levels of environmental protection being sought through legislation will impact on all growers, but particularly those involved in the high value potato and vegetable crop sectors where irrigation is an essential component of crop production. The original benefits of irrigation in terms of yield increase, whilst still necessary, have been superseded by market demands for crop quality. Whether producing for the fresh food market or for the food processing industry, growers are being required to supply high quality, closely specified produce at a consistent rate throughout the growing season. The vagaries of UK summer rainfall have now made irrigation a necessity rather than a luxury (Weatherhead *et al.*, 1994). Indeed, without adequate and reliable water resources, some growers cannot even obtain sales contracts (Knox and Weatherhead, 1999).

Reflecting these environmental and legislative pressures to move towards an optimum use of water, growers are also under pressure to demonstrate improved levels of on-farm water management. For example, grower protocols now form part of contracts to supply the major multiples, and assessments of "reasonable need" are to form part of the evaluation procedure for growers applying for, or renewing existing abstraction licences for irrigation. In this context, the provision of irrigation advisory services in the UK will undoubtedly become more important in promoting and achieving improved levels of water management at the farm level.

This paper describes the nature of irrigation advisory services in the UK, including a detailed examination of the irrigation scheduling sector. It considers some of the current and future key issues facing growers and those involved in providing irrigation advice.

#### **Government irrigation advisory services: a brief history**

Until the mid 1990s, most agricultural extension advice available to farmers was provided by a government-funded service, known as the Agricultural Development and Advisory Service (ADAS). ADAS evolved from the National Agricultural Advisory Service (NAAS) which was formed in the immediate aftermath of the Second World War to harness new technologies to boost agricultural production. Since then ADAS have provided a range of advisory services, not just in irrigation, but ranging from crop production through to whole farm business management. Recently, however, ADAS has been privatised. This was a consequence of a government review of spending in agriculture combined with the premise that farming would remain a profitable and sustainable sector (and the assumption that farmers could afford to pay for such advisory services). The process was completed in stages, with government support gradually being withdrawn to the point where the service became fully privatised. There is, therefore, no state-funded advisory service for farmers and growers, although the Department for Environment, Food and Rural Affairs<sup>1</sup> still publishes advisory leaflets (e.g. MAFF, 1996).

#### **GENERAL IRRIGATION ADVICE**

##### **Privatised ADAS**

The basis of the privatised ADAS service continues to be agricultural extension, with front line contact with farmers through crop specialists e.g. potatoes, vegetables, dairying etc. Their role is to develop good working relationships with farmers in their area by making regular visits, and developing an intimate understanding of individual farms. It is also important though that these specialists have a broad knowledge of farming, as their role is also to identify and discuss the wider issues and problems of farming e.g. irrigation, farm buildings, machinery. Once a specific problem is identified, say in irrigation, an irrigation specialist is assigned to investigate. The

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<sup>1</sup> DEFRA has taken over the responsibilities of the Ministry of Agriculture, Fisheries and Food

farm advisors work very much like doctors or general practitioners in medicine. They provide advice on a wide range of subjects but they know when to bring in a specialist to advice on a specific problem. This model has worked well both in the early days and also under privatisation.

An aspect of privatisation has been a significant reduction in staff and the customers they serve. When government funded ADAS employed more than 3,000 staff but now this down to less than 1,000. The number of farms they now serve has also dropped to around 200 and these tend to be the larger enterprises that can afford to pay for such services.

ADAS staff in UK continue to provide irrigation advice ranging from system and reservoir designs, equipment choice and a bureau style irrigation scheduling service. These services are now provided on a commercial basis and ADAS must compete against other irrigation consultants for business. However, ADAS claims to be perhaps the only organisation really able to provide a comprehensive irrigation service to farmers from the identification of need through to design, construction, implementation and management.

ADAS continues to have a research role, which is largely government funded on a contract basis. Their research in irrigation is limited, with the intensity of research tending to mirror periods of drought in the UK.

### **Irrigation suppliers and consultants**

A recent study of the UK irrigation industry suggested that there were approximately 150 companies involved in the provision of irrigation equipment, sales and advice. As would be expected, the industry is dominated by a few large companies, although there is an increasing number of small companies, often consultants working independently and operating within specific sectors (e.g. glasshouses, soft fruit, amenity irrigation) and offering specialist irrigation advice and consultancy. These consultants have absorbed much of the traditional low margin activities previously undertaken by the national irrigation advisory service. These consultants have the advantage of lower operating costs (overheads) and can afford to provide a more personal service with direct face-to-face farmer contact.

For many decades, the dominant irrigation sectors in the UK have been in agriculture and horticulture. UK crop production in these sectors is now facing significant pressure from European and global markets, with the consequence that equipment sales within these sectors have, to some extent, stagnated. Investment in new irrigation equipment is not a high priority in times of insecurity, both as an industry and for individual farms. In contrast, sales in irrigation equipment and presumably advice are flourishing within the sportsturf (golf), amenity and leisure sectors, although published information on the specific sectors is limited (the sports and leisure sector overall is second fastest growing industry in the country). In the medium term it is likely that this trend in irrigation will continue, and as pressure on water resources, and hence costs, increase, it is likely that these sectors, which rely predominantly on expensive mains water, will increasingly seek irrigation advice (scheduling) provided to the more traditional irrigation sectors since the 1960s.

There are also private companies that provide irrigation advice in specialised areas. For example, engineering consultants provide design and construction supervision services for boreholes and reservoirs, equipment suppliers usually provide advice on in-field systems and some companies provide scheduling services e.g. using neutron probes, tensiometers or calculation based services. The provision of scheduling services is described later in this paper.

The rapid increase in the use of personal computers and access to the internet has also provided growers with a new (and usually free) form of irrigation advice. A number of dedicated discussion lists are in operation, focussing on specific subject areas (e.g. trickle, soil water measurement, drainage, salinity). Membership of these list servers enable users to submit

questions or requests for information to an international collection of suppliers, advisors, scientists, academics and consultants.

### **UK Irrigation Association**

For many growers, the UK Irrigation Association (UKIA) is their first point of call when seeking irrigation advice. The UKIA was founded in 1980, following a period of severe drought in the late 1970s. Its objective is to promote all aspects of irrigation by providing information and helping to raise the standards of knowledge and competence in irrigation design, installation and management. The Association is active in and represents all aspects of irrigation in the UK including agriculture, horticulture, golf, amenity, sports surfaces and landscaping. It is managed by an Executive Council, with members representing different sectors of the UK irrigation industry. Daily administration of the association and the initial point of contact for members seeking irrigation advice is through an appointed Executive Secretary.

The principal activity of the UKIA is therefore collecting and exchanging up-to-date and relevant information about irrigation, and promoting an interest in, and better understanding of, its use. The dissemination of advice to members is achieved through a variety of media, including newsletters, a journal and the Association's website. The website contains, amongst other information, a directory of irrigation suppliers and consultants. In addition, the Association organises field trips, technical seminars and an annual conference. It also actively involved with international irrigation standards, short courses and training, and responding to government consultations regarding water resources policy and legislation. It therefore helps to provide members with an impartial and comprehensive source of information on the key issues that are likely to impact on both abstractors as individuals and as an industry.

Membership of the Association is open to everyone with an interest in irrigation, particularly farmers and growers but includes manufacturers and suppliers of irrigation equipment, advisers, consultants, contractors, representatives of government, researchers, college and university staff. Membership is available to individuals and nominated members of organisations only, and is not therefore a trade association. During periods of drought, annual membership has exceeded 700, but typically fluctuates between 200-300. Although this represents a small proportion of licensed abstractors, the core membership includes most of the major irrigators and key stakeholders involved in the UK irrigation industry. One problem faced by organisations such as the UKIA is whether to limit irrigation advisory services to members only, or to provide open advice to all and risk declining membership.

### **IRRIGATION SCHEDULING ADVICE**

Scheduling is defined as determining which fields to irrigate, when and how much. The objective is to maintain an optimum soil water environment, to ensure that the most economic yield, most efficient use of water *or* highest crop quality are achieved. Irrigation scheduling provides the irrigator with information on his crop water needs so that he can ensure that irrigation applications are timely and of sufficient quantity.

Although the average irrigation requirement is generally low irrigation scheduling in the UK is a remarkably complex operation. The reason for this is that the variability of summer weather means that irrigation requirements vary markedly week to week and year to year. Without scheduling it is difficult to keep track of what is happening.

A wide range of irrigation scheduling methods are currently available and used commercially under UK conditions. These broadly fall under two categories, either water balance methods or direct measurement techniques.

## Soil water measurement systems

Direct measurement techniques measure soil water content or potential *in-situ*. Irrigation is then scheduled according to a target soil water content (or deficit) or potential. There are many instruments available on the market for measuring soil water status, but few farmers have the expertise, time or experience to use these effectively by themselves. There are therefore a number of irrigation scheduling advisory services that assist the farmer.

### *Neutron probe*

The neutron probe is undoubtedly the most common method currently used by farmers in UK. A neutron probe is lowered down an aluminium access tube that is installed in the field and measurements of soil water content can be taken at any depth.

Although portable and quick, they remain expensive and are subject to strict legal controls. For example, in UK use of the neutron probe is covered by the Ionising Radiation Regulations (1985), the Radiological Substances Act (1993) and the Radioactive Substances Carriage by Road Regulations (1996). Therefore irrigation scheduling by neutron probe is almost exclusively provided by commercial scheduling services. Usually a consultant visits the farm on a weekly basis, collects and analyses field data on-site, and provides an immediate report to the farmer on the current soil water status and forecast for irrigation for the following week. Four major operators have formed an alliance to cover the UK. A number of these consultants operate in the UK during the irrigation season, and in the southern hemisphere during the British winter.

This direct contact approach has proved popular with farmers and gained confidence within the irrigated farming community and hence continues to grow strongly. However, the commercial services rarely calibrate the neutron probes *in-situ* and they may give inaccurate readings when using the manufacturer's calibration. Also, the probe is not good for determining changes in soil moisture in the top 20 cm of the profile (which may be critical for shallow rooted crops) and its value as an irrigation scheduling tool has been doubted (Gaze, *et al.*, 2002).

### *Capacitance probes*

Recently, capacitance probes have been used for scheduling. The system avoids the safety and legal limitations of neutron probes and can be used effectively at, or near, the surface. Permanent systems, such as the EnviroScan™, can be linked to a central processing system allowing the farmer to evaluate the soil moisture status at any time. Potable systems, such as the Diviner™, can be used with access tubes, rather like the neutron probe.

Permanent systems can reveal more information about the performance of the irrigation system and plant water uptake than potable systems, but have a relatively high capital investment cost, thus they are only likely to provide major benefits to the larger and more sophisticated irrigator. Although capacitance based systems are sold directly to end-users (with supporting software), more commonly, the system is 'rented' from a consultant who downloads the data (often remotely, using telemetry), interprets the output and returns irrigation scheduling advice.

The major limitation of potable capacitance probes is their small sampling range, making measurements sensitive to compaction or soil disturbance caused by access tube installation.

### *Tensiometers*

Tensiometers, which are cheap and easy to read, are particularly suited to scheduling water sensitive crops grown on sandy soils. Although popular within the horticultural sector, they require careful installation, can be unreliable and are difficult to interpret accurately. Various services have been offered to farmers and growers in the UK to support scheduling by tensiometer in the past (e.g. Dent and Hay, 1988). They carried out a survey of the soils to

determine critical soil water potentials for the crops to be grown, supplied the instruments and advised on their use.

### **Water balance methods**

Water balance methods keep a running mathematical balance of the water in the soil profile from measurements of rainfall and irrigation amounts and estimates of evapotranspiration. Since the 1950s, growers have been encouraged to keep a water balance for individual fields using the regularly published evapotranspiration estimates for their region (MAFF, 1954). Using a simple water balance sheet, the farmer kept a daily record of rainfall and irrigation applications (MAFF, 1981). Some crude adjustments of potential evapotranspiration were incorporated into the method to account for incomplete ground cover, but to keep it simple there were no adjustments for crop type. Using this method the grower could track the daily soil water status and schedule irrigation accordingly.

The water balance approach has been greatly assisted by the advent of the personal computer and a number of more sophisticated models are now available (e.g. Hess, 1996a). In the 1980s a system was operated by ICI that provided the grower with a portable computer and software for scheduling (Turvill, 1988). Today, software is available for farmers to schedule their irrigation using their own PCs (e.g. IMS, Happy Irrigator) and a number of farmers use their own spreadsheets (e.g. Hess, 1993). These allow them to keep it up to date and use it for interactive forecasting and planning as weather forecasts evolve.

#### *Evapotranspiration estimates*

For the farmer, estimating evapotranspiration can be expensive and time consuming. Evapotranspiration can be determined from meteorological measurements made on the farm or provided by an advisory service (Hess, 1996b). Evapotranspiration bulletins, based upon Penman calculations, have been issued at various times by the Ministry of Agriculture, Fisheries and Food (MAFF) and the national Meteorological Office.

Improvements in the Penman approach led to the development of the Meteorological Office Rainfall and Evapotranspiration Calculation System MORECS (Thompson *et al.*, 1981). Weather data are collected from a network of more than 200 synoptic weather stations and interpolated for 190 grid squares, of 40 × 40 km, covering the whole of the UK. The interpolated values are then used to calculate potential evapotranspiration using and Penman-Monteith 'type' approach as well as estimated actual evapotranspiration and soil moisture deficit for a number of surfaces and soils (Thompson *et al.*, 1981). Weekly reports are sent to the farm by post, fax or email and the charge varies according to the number of parameters required.

#### *Bureau services*

Since the late 1970s there have been a number of commercial 'bureau' scheduling services using water balance models. Most of these services operate in a similar way. The soil texture is identified by a advisor who visits at the start of the season and soil hydrological characteristics are estimated. During the irrigation season, meteorological information is obtained from a service such as MORECS (see section above) by the operating bureau. Rainfall and irrigation are measured at the site by the grower along with relevant agronomic data such as crop planting dates, emergence dates, and leaf cover percentage, if available. These are sent to the bureau by post, telephone, fax or email, usually weekly. On receipt of the farm information, the model is run and the irrigation requirement for each individual field for the coming week is returned to the grower. The main bureau services operate in the UK are;

- Irriguide. ADAS and the Meteorological Office jointly developed an irrigation scheduling service called 'Irriguide' that was explicitly built around the MORECS evapotranspiration

model (Bailey and Spackman, 1996). The accuracy of 'Irriguide' has been proven experimentally in the UK by extensive trialling against neutron probe measurements under potatoes and vegetables (Bailey *et al.*, 1996).

- CUPGRA. The Cambridge University Potato Growers Research Association (CUPGRA) is a grower funded research group that provides a bureau based scheduling services to its members in England and Wales. It only provides advice for potatoes.
- SAC. The Scottish Agricultural College provides irrigation scheduling advice, based on a spreadsheet water balance and MORECS evapotranspiration estimates, as part of a general agronomy package for farmers.

Until recently, Levington Agriculture provided a bureau service (Paulson, 1988) which was provided free to growers by a fertilizer company as an incentive for good customers, and perhaps as a way to ensure their representatives maintained access to farmers.

### **Combined water balance / soil water measurement services**

Model based systems are cheap to operate and are optimally run by the farmer on his own PC linked to his own automatic weather station. However this level of sophistication requires a large farm with several fields under irrigation and considerable commitment on the part of the grower. The commercial services provide this commitment and provide the service for the smaller grower with only one or two fields under irrigation.

The weakness of the modelling approach is that it is only as good as the input data. Irrigation applications can vary across the field and what a farmer thinks he has applied is often not what reaches the ground, rainfall can vary across the field, crop cover varies and so on. With care and effort (use of in-field rain gauges, grids to assess crop cover etc.) these variables can be monitored and the system made to function accurately but where this care is absent the model can quickly show major departures from reality.

With all water balance approaches, the scheduling advice is sensitive to the accuracy of the input data. With a bureau service it is difficult to verify the input data and cumulative errors can lead to significant errors in scheduling advice (Hess, 1996a). The more successful services rely on a specialist individual operating the system, who can spot obvious anomalies and contact the grower if necessary to verify the data.

The Irrigation Management Services (IMS) scheduling service provided a water balance scheduling service to farmers and growers in eastern England in conjunction with *in situ* monitoring of soil water and crop cover (Hess and Mathieson, 1988). The system was well received and overcame many of the limitations of the water balance or soil water measurement approaches alone (Hess, 1990). However, it proved expensive to operate on a small scale and the service was terminated in 1990.

### **Current usage**

Various studies have tried to gauge levels of current usage, by estimating the number of farms (and areas) using scheduling and the percentage split between the different methods being used.

In 1995 Weatherhead *et al* (1997) conducted a telephone survey of all known commercial irrigation scheduling companies. In 2000, a similar survey was undertaken by Mathieson *et al* (2000) and the major services have been re-contacted again in 2002. The results suggest that only 1 in 6 farmers in England are using commercial scheduling services. In 1995 bureau water balance services dominated the market (61%), with neutron probe/capacitance probe services accounting for the remainder. Since then, a major scheduling service has ceased operating and the proportion using soil moisture measurement appears to have increased.

An irrigation survey was recently conducted for the Department for Environment, Farming and Rural Affairs (Weatherhead and Danert, 2002) based on a sample of approximately 5500 questionnaires. These reveal that 23% of the total area irrigated in England was scheduled using water balance methods, 29% was based on in-field soil moisture measurement and 48% was scheduled by "other" methods, defined as non-scientific methods including operator judgement, feeling the soil and crop inspection.

However, the total irrigated area being scheduled is difficult to estimate. Many farmers subscribe to a service for a small number of fields and then extrapolate the advice to the remainder of the holding. Information on specific crop types being scheduled is similarly difficult to obtain. Estimates reported by the bureau services suggested potatoes accounted for between 25-50% of their scheduling business. Soft fruit (particularly strawberries) constituted 35-60% of crops scheduled by neutron probe, partly due to the concentration of fruit growers within a particular area of the UK, and also due to the particular advantages gained by direct soil moisture monitoring under trickle irrigation. Other crops scheduled include salad vegetables, root vegetables such as carrots and parsnips, apples and hops. Interestingly, a few farmers were also requesting bureau forecasts for scheduling cereals and even grass, despite their marginal or even uneconomic benefits of irrigation.

The continued relatively poor uptake of irrigation scheduling remains a reflection of the difficulty of being able to accurately quantify (or convince farmers) of the benefits that scheduling provides, particularly in dry years when many growers are more constrained by water resources and/or equipment rather than by water management decision making (scheduling). Most growers believe that they will get more benefit from risking over-irrigating rather than under irrigating. The marginal cost of applying water is relatively low at £0.16/m<sup>3</sup> (Weatherhead *et al.*, 1997) when compared to the extra net margin on say maincrop potatoes at £0.65 per m<sup>3</sup> of water 'usefully applied'. On the other hand, many systems are under-designed and the grower does not need scheduling to tell him to apply more water when he does not have the capacity to apply it. It is simply easier to keep irrigating at or near the capacity of the system unless extreme rainfall events occur. This probably explains the relatively poor take-up of scheduling especially where water resources are not limited.

## **Cost**

The charges levied by bureau services vary, since scheduling is often provided as part of an overall agronomic consultancy package. For scheduling only advice, cost depends on the total number of sites forecast per farm or the size of field for which information is collected. For bureau water balance services, typical quotes range between £100-£150 per site per season, or £10-£12 per ha per year (Weatherhead *et al.*, 1997).

Neutron probe service costs typically range from £200-£300 per site (based on 2 or 3 access tubes) per season. Some companies also charge an initial access tube installation fee (£50). For capacitance probes a typical installation comprising up to 32 soil moisture sensors, a monitoring system with a central data logger and staff training costs around £10,000.

A computer based water balance scheduling model for use on-farm, such as IMS (Hess, 1994) costs £150. Other data necessary (evapotranspiration data) supplied by the Met. Office typically costs £200 per season. Alternatively, an automatic weather station suitable for irrigation scheduling costs about £2000 (Hess, 1996b).

## **OUTLOOK**

The use of irrigation scheduling and irrigation advisory services in general may well change as pressure comes from the government (notably via the Environment Agency) and the retailers to demonstrate increased levels of water (including irrigation) efficiency. The former is concerned

with the sustainable management, allocation and conservation of a limited resource, and the latter with marketing produce that can be shown to have been produced using environmentally sustainable methods and grown by responsible farmers who use water wisely. In this context, farmers could benefit from using irrigation scheduling services twofold; firstly, to help provide data in support of their requests for licensed volumes of water on their abstraction licence; and secondly, to satisfy the requirements of the various grower protocols. Many of these protocols suggest that a “scientifically recognised” method of scheduling should be utilised (e.g. Assured Produce, 2001). Although considered a relatively low priority risk at present, increased pressure on water resources will undoubtedly result in greater enforcement.

An interesting trend in the UK has been the gradual fall in profitability in farming and there are now real concerns regarding farmers’ ability to pay for advisory services. In response to this, DEFRA, the government department responsible for agriculture has been gradually re-building support services to assist farmers to diversify away from mainstream cropping into other rural activities. For example, the England Rural Development Plan which forms part of the Common Agricultural Policy (CAP) now has funding for schemes to enable farming, forestry and other rural businesses to develop and adapt. One of these schemes has grant aid opportunities for growers to improve their on-farm agricultural water resources management. Although primarily aimed at larger scale infrastructure developments, the installation of in-field soil moisture instrumentation to assist in irrigation scheduling and thereby improve on-farm water resources management could be considered (Knox, 2001).

Finally, the sustainability of many farm businesses in the UK has been impacted by European Directives, particularly for farms located within environmentally sensitive areas. The Water Framework Directive (WFD) adds further European legislative pressure on farmers, albeit in a less direct manner. It requires the integration of agricultural, industrial, rural development, nature conservation and forestry plans on a catchment basis, with the objectives of maintaining water quality and water quantity through sustainable development. Such measures will, for example, require that growers demonstrate that the licensed volumes they are requesting are indeed reasonable and that licensed abstractions recognise the economic value of water. In support of this, the government’s Environment Agency (EA) are developing methodologies and benchmark data to assess ‘reasonable’ or optimum needs for irrigated agriculture. All new abstraction licences for irrigation will be assessed by the EA using this more rigorous and scientifically based assessment methodology. Clearly, any data, for example, arising from the use of a scientific irrigation scheduling method may well help a grower to substantiate their request for the volume of water being demanded. Furthermore, improved knowledge and information on the amounts and timing of irrigation being applied, by crop type, will help a grower to quantify the economic value of the water they are abstracting. It is apparent that in the near future, farmers that continue to rely on anecdotal evidence of their irrigation practices will face increasing difficulty when trying to demonstrate their ‘reasonable need’ when applying to renew their licence/s to abstract water for irrigation.

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