Farm GPS & VRA Information Note

Embracing Technology to Improve Sustainability

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Technology Summary In the last 30 years farm machinery manufacturers have incorporated GPS (global positioning systems) and VRA (variable rate application) technology into their products and progressive farmers have embraced this to enhance the efficiency and sustainability of their field work. Classed as a precision agricultural technology, various machinery designed with the technology can be combined with steering mechanisms in a range of agricultural vehicles; i.e a tractor, self propelled sprayer or combine to transform a variety of farming tasks. The technology can guarantee benefits such as site specific crop application, no missed or overlapped spray passes or missed crops in fields of undulating terrain. GPS and VRA are here to stay and millions are being spent on the R&D of these evolving machines. This brief note sets out the benefits and potential profitability from investing in the products as well as some helpful tips when it comes to purchase decisions.

How can GPS help my farming system?

Arable, red meat, dairy etc. The technology has made in roads into every Scottish farming enterprise. For example, in lowland farms reducing carbon emissions through using less pesticide on crops, to more upland farms targeting slurry applications on a plant nutritional level, to hill land GPS soil sampled for precision liming and fertilising on hillier pasture. Understanding the capabilities of GPS and VRA for your farm is important as the type of machinery lends itself better to different situations. For example you may want to GPS soil sample your farm but if you do not have a VRA spreader for fertiliser this will not be any use. Therefore, working out what machinery can work together with the GPS technology is key.

GPS can be used for purposes such as field planning, field mapping, soil sampling, tractor guidance, crop scouting, yield mapping, variable rate applications of seeds, lime, slurry, fertilisers, fungicides and pesticides, With GPS, it is easier to match production techniques or crop yields with land variability. It requires a time and financial investment, as data gathering and data interpretation takes time. Ask your local consultant if you require help in this matter.

What is the use of GPS?

GPS is a technology that is a time and position reference systems. The technology can integrated with a host of modern agricultural vehicles though the use of on-board computers. Combine this mechanism with data collection sensors and you have the ability to do some serious precision farming. Getting the proper benefit of an accurate GPS system means investing in some sort of automated steering device. Autosteer for example, uses GPS monitors, tracks and navigates equipment to allow farmers to have more control of every portion of their land. The expending of fewer resources whilst increasing production yields is a major benefit of using GPS devices.

For more information on Precision technologies visit www.fas.scot.For dates of arable vents, find us on Facebook or

The European Agricultural Fund for Rural Development
Europe investing in rural areas

Scottish Government
Riaghaltas na h-Alba
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Farming & Water Scotland

SAC Consulting

Benefits of GPS for general farm work

GPS improves the health and safety of tractor work. For example, low visibility conditions may previously have stopped fieldwork, now through this navigation information field work can continue safely. GPS improves the longevity of machinery as it can be combined with older tractors and combines. GPS works with a range of farm tools. Technology such as Auto-steer can take control of tractors and uses real time kinematic (RTK) correction of GPS signals to get millimetre accuracy of field work. This is a more expensive but a highly sought-after option. A cheaper alternative is a Light bar guidance system—mounted in the cab it provides direction to the driver through an app or display in the tractor. It mainly assists with straight driving. Some GPS adapted machinery can also adjust according to terrain and thus prevents damaging booms or scorch to crops. Also, GPS ensures no missed passes and when used with section control it prevents overlaps of sprays, thus improving efficiency of time, delivering precise crop cover and wasting no products.

GPS aids in precision sowing technology, this alters depth and seed rate depending on soil type and field history data. GPS also improves aesthetics of field work in placing furrows in a field with centimetre precision. It is also another tool to help improve the business in labour, capital and fuel savings and bring about better efficiency. The technology is also helping to 'green' the farm through lessening inputs. Using GPS precise nutrient application in fields is easy, and this prevents lodging, striping, and helps grow a more uniform crop. Furthermore, Nitrogen (N) Fertiliser can be tailored to plants by their crop reflectance rate using spatially variable application N technology. This uses VAR auto calibration, altering the flow and rate depending on location in the mapped field. Combine this with a spread pattern sensor and you have the machine compensating the spread pattern according to wind speed as well. GPS is also used in crop edge sensing and greatly improves efficiency of harvest operations.

Useful Information

- Visit our webpage www.fas.scot for more information about the Soil & Nutrient Network and soil health and management.

GPS Return On Income (ROI)

The financial return on income ROI are modest for a number of single GPS technologies but the real benefits are from combining the technologies, using auto steer and implementing on a larger scale. For example, many have found they cover a greater acreage using GPS than previously. So their ROI has been in a few seasons.

GPS can be profitable early on from investment when tramline distances are accurately measured allowing for control traffic farming (CTF). This reduces compaction and increases yield. Also a minimal 5% saving in field inputs by eliminating overlap. Overlap is traditionally built in conventional systems. A further 2% input saving per field through eliminating operator error might also help justify the cost. Moreover, the chemical inputs saving using GPS (with section control for example), depends on the skill of the operator and this can be between 2 and 20%. ROI is only likely to happen quickly providing the technology and machinery purchases are suitable for the farm type and the farmer has an idea of what financial % impact the inefficiencies as mentioned above actually have on the bottom line.

In a new age of unlock fees and annual subscriptions for correction signals. These can seem expensive but the reduction in input costs generally results in a better payback.

Be aware of...

The cost of machinery, shop about and take advice; Having good back-up field data systems in place; The depreciation of equipment vs realistic yield gain; Maintenance costs; Licence for correction signals and time input. GPS equipment cannot always be changed to another tractor.

Variable Rate Application (VRA)

Variable rate application (VRA) is used on a host of farming apparatus, to name but a few: fertiliser spreaders, lime spreaders, and pesticide booms. The purpose of the technology is to spread a precise amount of product (fert, lime, chemical) upon a field based upon a location in the field. The system works by having a controller that is linked to field map data such as plant biomass, soil nutrient status, or plant leaf green area. The computer apparatus then links this data on the agricultural vehicle with the location of the tractor in the field via a position locator, such as LORAN. The system then determines the dispensing rate of the spreader by accessing the speed of the tractor via a speed indicator and adjusting the flow rate. The various field maps are then updated after a dispensing pass to provide a real-time record. This method ensures crop requirements are met in the most efficient and effective way as well as ensuring no input is wasted.

10 Environmental Reasons to Move to VRA

1. **Reduces farm carbon footprint through reduction in inputs and diesel.**
2. **Ensures best practice of crop control as advised by the government in Integrated Crop Management (ICM).**
3. **Reduces potential environmental risk from nutrient/chemical run off as field capacity of fertilisers or chemicals are not breached and plants have a more tailored agronomy.**
4. **Ensures crop management optimum efficiency and profitability, because the method of alternative uniform application of crop inputs is inaccurate as fields are rarely uniform in their chemistry, biology and physical make-up.**
5. **Reduces environmental pollution from nutrient losses to water bodies which outweigh the inconvenience associated with the change and implementation of VRA.**
6. **Ensures crop Nitrogen requirements are met whilst reducing Nitrogen input as VRA N management reduces total N fertilizer use without decreasing grain yield.**
7. **Reduces lodging risk. A crop that has a large canopy or access to lots of nutrition may lodge. Plant Growth Regulators (PGR) applied via VRA are matched to crop canopy using vegetation indices on plant biomass status. This delivers multiple agronomic, financial and energy saving benefits.**
8. **Ensures sprays achieve equivalent or greater efficacy in insect and disease control in some situations than conventional constant spray sprayers.**
9. **Reduces fungicide requirement as dose of spray can be based on the above-ground amount of leaves and stems, as measured with crop reflection sensors. The more biomass present, the higher the dose of the fungicide should be.**
10. **Ensures that the high financial costs of implementing VRT (sampling, mapping, equipment, and personnel) have instant significant environmental savings, whilst the financial Return On Investment (ROI) may not be received in a growing season in profits.**

This is one example of advised practice for Farmers & growers as part of ICM. Remember you cannot improve what you do not measure. VRA is only as useful as the data collected, the calibre and calibration of machine in use.