



Precision Farming Glossary



Precision Farming Glossary

A-B line

a straight line between two points, A and B, chosen by a machine operator and calculated by a guidance system

♦The A-B line defines a series of wheelings, a fixed distance apart, across the whole field. *Also called* **guidance line**

accuracy

in precision farming, the precision with which a positioning system can locate a point at which data is recorded or the position of a vehicle ♦Different systems vary in their accuracy and their suitability for different tasks. There are three levels of accuracy in a GPS system: low (+/- 50-100 cm), medium (+/- 10 cm) and high (+/- 2 cm). *See also* **pass-to-pass accuracy, RTK accuracy, static accuracy**

active light sensor

a light sensor that emits its own light to illuminate the crop and measure the amount of light reflected from it. ♦Active light sensors usually only capture a relatively small number of wavelengths because it is difficult to produce a bright enough light.

active sensor

a device that generates a signal, bounces it off an object, and measures the signal reflected from the object. *See also* **passive sensor**

ADP

See aerial digital photography

aerial digital photography

high-resolution data capture of features on the ground by a digital camera mounted on a plane or on a balloon, mast etc. *Abbr.* **ADP**

airborne remote sensor

a sensor mounted on a plane or on a balloon

airborne scanner

an ultrasound, laser or other scanner mounted on an aircraft, providing continuous data on ground or crop features under a flight path

algorithm

a set of steps or rules for making calculations or solving problems, as used in computer programs

application map

a plan showing the location and rate at which seed, fertilisers or agrochemicals will be applied across a management zone. ♦An application map is derived manually or automatically from analysis of yield maps, weed maps, etc.

area mapping

the production of a plan which defines an area in a field or a field boundary, or calculates the size of an area, by remote sensing technology

ASC

See auto section control

assisted steering

an adaptation of the steering system of an existing vehicle to GPS automation,

by replacing the standard steering wheel with a powered version, or fitting a drive mechanism to it

auto guidance

See guidance

auto section control

a system that operates boom sections automatically using a positioning system and precise on-off timing to minimise over-application caused by overlapping or missed areas caused by underlapping. ♦ASC can be used on self-propelled, trailed or mounted sprayers. Abbr. **ASC**

automatic machine control

computer control of operations carried out by agricultural vehicles, based on a positioning system and often combined with information collected by remote sensing technology. ♦Automatic control can be used to control, for example, steering, headland management, spray boom height and rate of application of seed, fertilisers or agrochemicals

auto steering

See automatic steering

automatic steering or auto steering

a system based on GPS signals that steers a vehicle across a field without overlapping or underlapping. ♦Auto steering is used on tractors, combines, and forage harvesters, and on self-propelled sprayers, spreaders and mowers

base station

a fixed site that sends and receives telecommunications signals. *See also*

virtual base station

biomass map

a plan that shows the variation in the crop canopy within a field, based on the data from a biomass sensor. ♦It can indicate differences in soil fertility and therefore crop nutrient requirements, allowing fertiliser to be applied at different rates in different places.

biomass sensor

a remote sensor that measures biomass by measuring the light reflected from the crop canopy. ♦The data can be combined with GPS to make maps of canopy size, indicating differences in soil fertility. *See also*

biomass map

boom levelling

automatic adjustment by ultrasound sensors of the height of a spray boom so that the spray pattern is uniform. ♦Sensors mounted at the centre and tips of the booms monitor nozzle height above the ground or crop and feed the information to a computer that makes small alterations to the boom hundreds of times a second. The boom can also be raised on headlands to avoid obstacles.

boom section

a part of a spray boom that can be turned on or off independently from other sections along the boom. ♦Automatic systems control boom sections using a positioning system and precise on-off timing to minimise over-application caused by overlapping or missed areas caused by underlapping.

boom-mounted radiometer or boom-mounted sensor

a radiometer or sensor that is fixed onto a spray boom

CANBUS

a digital wiring system that connects different control units in a vehicle such as a tractor or combine, allowing data for machine control and diagnostics to be transferred between them ♦CAN is an abbreviation of 'Controller Area Network'.

canopy

See crop canopy

canopy management

the careful planning of seed rates, nitrogen rates and timing of operations to achieve an optimum crop canopy for light interception ♦Optimum canopy should produce optimum yields in relation to nitrogen use.

canopy sensing

the process of collecting information on crop characteristics such as biomass and chlorophyll content from a distance, by means of satellite, aerial or tractor-mounted remote sensors. See also **crop reflectance**

compaction

compressed soil structure caused by pressure on the soil by vehicles, producing poor growing conditions ♦Soil compaction has a significant negative effect on crop yields. Factors associated with compaction that reduce growth potential include oxygen supply, volumetric water content and vulnerability to losing nitrogen into the atmosphere; the crop may also root poorly.

compatibility

the ability of mapping software to work with different makes of machinery control equipment

controlled traffic farming

a management system that ensures that all the vehicles used in a field keep to the same permanent traffic lanes every year in order to restrict compaction of the soil to the smallest possible area ♦The benefits are improved soil structure on untrafficked areas, which then require less tillage and have better drainage and less erosion, with resultant yield increases. *Abbr.* **CTF**; See also **random traffic farming**

correction signal

a radio signal that improves the positioning accuracy provided by the basic GPS signal to much less than one metre ♦Inaccuracies in the GPS signal, caused by interference in the ionosphere and other factors, are measured and correction data are broadcast, also via satellite or ground system, to the GPS receiver in the tractor or other vehicle. See also **EGNOS correction service, RTK accuracy**

crabbing

the tendency of a machine to slip sideways from its line of pull

crop calibration

the adjustment of machinery to the characteristics of a specific crop at a specific time, such as moisture content at harvest, or the different reflectance characteristics of different wheat varieties

crop canopy

the parts of a plant, especially the leaves, that receive light from the sun and shade the ground beneath ♦Effective canopy management

ensures that each plant has the light and space to maximise yield. *See also* **green area index, leaf area index**

crop reflectance

the amount of visible or invisible light reflected by a crop ♦ Infrared reflectance, which cannot be seen by the human eye, broadly measures canopy size/biomass and together with the amount of visible green light reflected from a crop gives an indication of its total green area. *See also* **normalised difference vegetative index**

crop sensing

the process of collecting information on crop characteristics such as biomass and chlorophyll content from a distance, by means of satellite, aerial or tractor-mounted remote sensors. *See also* **crop reflectance**

crop variability

differences in crop yields within a field caused by factors such as differences in soil type, soil fertility, compaction and previous cropping patterns

CTF

See Controlled Traffic Farming

data collection

in precision farming, the gathering of information on fields and crops in digital form by sensors, in addition to data collected manually or visually

data logging

the automatic recording by a computer of information gathered digitally over time

dGPS or DGPS

See Differential Global Positioning System

differential correction

See Differential Global Positioning System

Differential Global Positioning System

a system for providing a very accurate position, by calculating the difference between the actual location of a fixed-position ground station and the satellite-located position of the station, and providing a correction signal to a mobile user, either directly from a ground station or via a satellite ♦ This system corrects for errors introduced by interference with the GPS signal and produces a very accurate signal of well below one metre, which agricultural applications require. *Abbr.* **dGPS, DGPS**

drift

the change in a GPS position over time, by up to as much as 1.5 metres in an hour. This variation occurs as a result of changes in the orbit of the satellites providing the positioning signal, which rise and set like the sun, as well as interference to the signal by atmospheric conditions. *See also* **static accuracy, pass-to-pass accuracy**

dual-frequency correction

in a dGPS system, a method of giving very precise positioning on the ground based on two unrelated frequency components, using a dual-frequency radio receiver. *See also* **single-frequency receiver**

EC

See electrical conductivity

EC mapping

the use of information on the characteristics of a soil revealed by measuring its electrical conductivity to create a soil map ♦EC measurements can be taken at two depths, referred to as shallow array and deep array measurements, and the relationship between the two can also provide useful information.

ECU

See electronic control unit

EGNOS

See European Geostationary Navigation Overlay Service

EGNOS correction service

a system that increases the accuracy of GPS and GLONASS signals by correcting disturbances in the ionosphere, sending corrections via the three EGNOS satellites to GPS and GLONASS users with an EGNOS receiver. It is free at the point of use.

See also **European Geostationary Navigation Overlay Service**

electrical conductivity

a measure of how easily an electrical current flows through a material such as soil ♦The electrical conductivity of a soil sample indicates the amount of salt, sand, clay, organic matter, and water it contains, so with GPS input it can be used to create a soil map. Measurements can be taken at two depths, referred to as shallow array and deep array measurements, and the relationship between the two can provide useful information. See also **EC mapping**

electromagnetic induction

a method of measuring the electrical

conductivity of soil by passing an electromagnetic wave through the ground. *Abbr.* **EMI**

electromagnetic radiation

radiation in the form of electromagnetic waves such as visible and invisible light rays, gamma rays, X-rays and radio waves

electromagnetic spectrum

the full range of electromagnetic radiation from the shortest to the longest waves

electro-optical sensor

a light-sensitive electronic device that creates an electrical signal proportional to the amount of electromagnetic energy that it receives

EMI

See electromagnetic induction

environmental variable

a factor in the environment such as weather conditions, or soil type or soil fertility, that can vary with time or place

European Geostationary Navigation Overlay Service

a European global navigation satellite system, based on three geostationary satellites, that augments the American GPS and Russian GLONASS systems by providing a system of differential correction that allows users to determine their position to within two metres, compared with about 20 metres for GPS or GLONASS alone. *Abbr.* **EGNOS**

FMCW

See frequency modulated continuous wave radar

frequency modulated continuous wave radar

a sensing system based on microwaves suitable for short-range applications such as control of working depth or assessment of soil for the control of seedbed quality ♦It has advantages over sensors based on optical or ultrasound devices in that it is unaffected by features of the agricultural environment such as dust and rain. *Abbr.* **FMCW**; *See also* **ultrasound sensor**

GAI

See green area index

General Packet Radio Services

a system that enables phones to transfer data at high speeds, typically 32-48 kbps, and at the same time as making a voice call. *Abbr.* **GPRS**

geographic information

See spatial information

Geographic Information System

software that captures and processes data, associating it with a position in a field. *Abbr.* **GIS**

georeferencing

the association of information on yield, pH, soil nitrogen or other factor with a position in a field ♦Map coordinates are assigned to an image derived by remote sensing.

geostationary telecommunication satellite

a satellite in a special orbit remaining in a fixed point above the Earth's surface used for receiving and relaying radio signals

geostatistical analysis

See geostatistics

geostatistics

statistics used for studying spatial patterns ♦Geostatistical analysis may be used to produce maps from data acquired at a relatively small set of locations.

GIS

See Geographic Information System

global navigation satellite system

any satellite-based navigational system that can locate points on the Earth's surface. *Abbr.* **GNSS**

Global Navigation Satellite System

(Globalnaya Navigatsionnaya Sputnikovaya Sistema)

a satellite-based navigational system based on a constellation of satellites owned by the Russian Federation government. *Abbr.* **GLONASS**

Global Positioning System

a satellite-based navigational system based on 24 satellites owned by the US Department of Defense ♦GPS is often used to refer to satellite navigation systems in general. *Abbr.* **GPS**

GLONASS

See Global Navigation Satellite System

GPR

See ground penetrating radar

GPRS

See General Packet Radio Services

GPS

See Global Positioning System

GPS guidance

See guidance

GPS-compatible controller

a system that can operate a sprayer, spreader or drill automatically according to an application map, using the Global Positioning System

graphic display unit

a device that receives digital data and converts it to a visual image

Green Area Index

the ratio of the total area of green plant tissue to the area of ground that the plant covers ♦It provides information on canopy size and aids decision-making on, for example, the amount and timing of nitrogen applications. *Abbr. GAI; See also leaf area index*

grid sampling

a sampling method that samples soil in squares on a grid across a field to determine soil type or fertility levels ♦The information can then be used to produce an application map.

ground penetrating radar

a non-destructive system that uses pulses of electromagnetic radiation in the UHF and VHF bands to penetrate the ground and create an image of the subsurface from the reflected rays ♦The depth to which it can penetrate is greater when electrical conductivity is lower.

ground station

a radio base station on the ground that receives and transmits satellite signals

ground truthing

observing and measuring something such as leaf area index in the field, to compare it with values calculated from an image obtained by remote sensing

ground-based sensor

a sensor mounted on a vehicle or building

guidance

a system based on a positioning system that shows a driver where to steer to cover a field at the spacing required for the implement being used without overlapping or underlapping ♦Guided steering avoids losses from underlapping or overlapping and allows more accurate working in the dark. It is also useful where there are no tramlines to follow, as in cultivations, drilling, pre-emergence spraying, autumn fertiliser spreading and lime spreading, and on grassland.

guidance line

See A-B line

guided hoe

a tractor-mounted hoe that is automatically steered to correct for tractor-driving inaccuracies and allow much finer hoe tolerances ♦The automatic guidance system is based on a digital colour video camera that scans the crop rows ahead for green shoots.

guided steering

See guidance

headland management

in precision farming, the use of a guidance system to control the turn made by a tractor at field edges automatically and precisely, controlling the implements and minimising overlap when lifting and replacing implements ♦The use of such a system increases the speed of turn and the accuracy of placement while reducing operator workload.

high-level accuracy

the highest level of accuracy of a positioning system to ± 2 cm. *See also* **RTK accuracy**

hyperspectral imaging

See hyperspectral reflectance spectrometry

hyperspectral reflectance

See hyperspectral reflectance spectrometry

hyperspectral reflectance spectrometry

the use of remote sensors to collect information about an object or area by building up an image based on hundreds to thousands of adjacent wavelength bands of the electromagnetic spectrum ♦Hyperspectral reflectance offers high resolution and may be used to help farmers assess the development, health and nutrient status of crops. *See also* **multispectral reflectance spectrometry**

hyperspectral sensor

See hyperspectral reflectance spectrometry

hyperspectral spectroradiometry

See hyperspectral reflectance spectrometry

implement control

See **GPS-compatible controller**

in-field variation

differences in a factor such as yield, soil fertility or soil type in different parts of a field. *Also called* **within-field variation**

infrared band reflectance or infrared reflectance

the reflection of invisible light in the infrared wavelengths of the

spectrum from an object or area

♦Infrared reflectance, especially near infrared reflectance, is used for remote sensing of soil and crop characteristics.

infrared sensor

a device that can detect information about a field, soil or crop from a distance, by measuring the amount of infrared light reflected from it

intelligent tyres

a system that maintains tyre inflation to a preset level, automatically inflating tyres that are below target pressure using air from an air tank, or allows an operator to change tyre pressures easily according to weight, speed and soil conditions

ISOBUS

an international standard, ISO 11738, for communication between tractors and implements ♦ISOBUS potentially allows the operation of different implements with one tractor control terminal.

ISOBUS-compatible

software and systems complying with the ISOBUS standard

kriging

a statistical technique that allows the calculation of unknown values from known values ♦By kriging, the value of yield or other characteristic at one location can be predicted based on its value at nearby locations. It may also be used for smoothing errors in data, such as those associated with the equipment used, to give more accurately representative information. There are several different kriging methods.

L1 frequency band

a radio wave frequency band centred on 1575.42 MHz, used in transmitting satellite positioning data. *See also* **single-frequency receiver**

L2 frequency band

a radio wave frequency band centred on 1227.60 MHz, used in transmitting satellite positioning data ♦ It is used in conjunction with the L1 frequency band signal to correct positioning information distorted by ionosphere interference, allowing location on the ground to within several centimetres. *See also* **dual-frequency correction**

LAI

See leaf area index

LCD

See liquid crystal display

leaf area index

the ratio of the area of the leaves of a plant to the area of ground the plant covers ♦ It is related to the efficiency of light interception and provides information on biomass production. Light sensors can be used to estimate LAI. *Abbr.* **LAI**; *See also* **green area index**

LIDAR

an airborne system that uses height data received from laser beams scanning the ground to provide very accurate maps of the ground surface ♦ It can be used for mapping soils, monitoring erosion, floodplain management, etc. LIDAR stands for 'Light Detection and Ranging'.

light reflectance

See crop reflectance

light sensing

the process of measuring from a distance the visible and invisible light reflected from a field, soil or crop, in order to assess various characteristics and calculate their values. *See also* **infrared sensor, light sensor**

light sensor

a device that can measure from a distance the visible and invisible light reflected from a field, soil or crop, in order to assess various characteristics and calculate their values ♦ Infrared sensors, which monitor the light reflected from a crop that cannot be seen by the human eye, broadly measure canopy size/biomass. The total green area of a crop is calculated as the ratio of this infrared reflectance measurement to the visible green light reflected from a crop.

liquid crystal display

a display of data created by changes in the colour of crystals caused by changes in electric current

localised damage

damage to crops in a specific area, caused by factors such as poor drainage, compaction, pH, or rabbits

location-based service

a service providing local and personalised information that can be accessed via the mobile network, based on the geographical position of a mobile phone. Services available include locating people, tracking vehicles, and weather reports. *Abbr.* **LBS**

low-level accuracy

the lowest precision of positioning offered by a dGPS system, +/- 50-100 cm

machine crabbing

See crabbing

management zone

a part of a field, identified from the analysis of a yield map or soil map, that is defined by a specific characteristic such as soil type or fertility or weed cover and is managed in an appropriate way ♦A field might be divided into several management zones.

mapping software

a computer program that uses GPS data to produce a map such as a yield map, a nutrient map or a treatment map, or that is used for the measurement of cropping areas

medium-level accuracy

the intermediate level of positioning offered by a GPS system, ± 10 cm.

See also **low-level accuracy**, **RTK accuracy**

multispectral imaging

See multispectral reflectance spectrometry

multispectral reflectance spectrometry

the use of remote sensors to collect information about an object or area by building up an image based on tens to hundreds of adjacent wavelength bands ♦The image for each waveband is displayed in a different colour in a composite image. See also **hyperspectral reflectance spectrometry**

nanosensor

a highly sensitive sensor based on nanotechnology ♦Nanosensors are designed to perform precise functions such as measuring individual proteins

or triggering electrical, chemical or enzymatic reactions in response to changing environmental conditions.

See also **smart sensor**, **remote sensor**

NDVI

See normalised difference vegetative index

near infrared reflectance

the reflection of invisible light in the near infrared wavebands of the electromagnetic spectrum from an object or area ♦Near infrared reflectance is used for remote sensing of soil and crop characteristics. *Abbr.* **NIR**

NIR

See near infrared reflectance

non-intrusive sensor

a device that can detect information about a field, soil or crop from a distance, without requiring samples to be taken, for example, EMI measuring equipment. *Also called* remote sensor

non-trafficked soil

soil that has not been driven over by vehicles and is therefore less compacted. See also **controlled traffic farming**

normalised difference vegetative index

the relationship between visible light reflectance and near infrared reflectance of a crop canopy, that allows assessment of its size, nutrient status and health ♦Healthy vegetation absorbs most of the visible light that it receives and reflects a lot of the near-infrared light, while unhealthy or sparse vegetation reflects more visible

light and less near-infrared light.
Abbr. **NDVI**; *See also* **light sensing**

nudge

the adjustment of guidance equipment to correct drift when a GPS position has diverged from a known position on the ground

nutrient mapping

See soil mapping

on the go

while working *See also* **real-time**

parallel working

the practice of steering a vehicle across a field in parallel passes without overlapping or underlapping by using GPS guidance when carrying out operations such as cultivating, sowing, spraying or harvesting

passive sensor

a light sensor that captures data in daytime, by measuring the amount of light reflected from the crop (for visible wavelengths), or absorbed and then re-emitted (for thermal infrared wavelengths) ♦Passive light sensors are affected by the angle of the sun and cloud cover, although some can correct for changes. *See also* **active sensor**

pass-to-pass accuracy

the accuracy of a positioning signal over the period of time taken to cross a typical field, usually taken as 15 minutes. *See also* **static accuracy**

patch map

a plan that shows where patches of agronomically important weeds are located in a field. *Also called* **weed patch map**

patch spraying

treating only the discrete patches of agronomically important weeds in a field with herbicide rather than spraying the whole field ♦There are considerable cost benefits from reduced herbicide use, while an environmental benefit is increased floral diversity.

permanent bed

an area of soil between permanent traffic lanes that is not run over by vehicles

permanent traffic lane

a strip of soil that is permanently compacted, created by a single vehicle wheel or track. *See also* **controlled traffic farming**

positioning signal

a signal broadcast by a satellite to a receiver on the ground which, when a minimum of three signals are co-ordinated, allows a location to be established

positioning system

a system of linked satellites that transmit radio signals to receivers on the ground, allowing a location to be accurately pinpointed ♦The core satellite systems are free, as are some of the enhanced dGPS systems such as WAAS (US) and EGNOS (EU). Subscription dGPS services offering high accuracy are available from commercial providers. *Also called* **global navigation satellite system**

potential for variable rate management

the possibility of applying seeds, fertilisers and agrochemicals effectively at different rates in different

parts of a field, as required by soil or crop condition. *Abbr.* **PVRM**; *See also* **variable rate technology**

precision agriculture

See precision farming

precision farming

management of farming practices that uses computers, satellite positioning systems, and remote sensing devices to provide information on which enhanced decisions can be made ♦Sensors can determine whether crops are growing at maximum efficiency, highly specific local environmental conditions can be identified, and the nature and location of problems pinpointed. Information collected can be used to produce maps showing variation in factors such as crop yield or soil nutrient status, and provides a basis for decisions on, for example, seed rates and application of fertilisers and agrochemicals, as well for the automatic guidance of equipment.

precision management

See precision farming

precision technology

aids such as positioning systems, remote sensors and guidance control equipment that can map variability in fields and direct inputs precisely and only where they are required

radiometer

a device that measures the amount of electromagnetic radiation, including visible and invisible light waves

radiometric data

information on crop or soil conditions obtained by sensors detecting visible

and invisible light reflected from surfaces

radiometric map

a plan created on the basis of the amount of visible and invisible light reflected from the area being studied ♦A radiometric map can identify differences such as those in soil fertility and crop disease.

radiometry

the measurement of electromagnetic radiation, including visible and invisible light waves

random traffic farming

the use of tractors and other vehicles on farm land where operations are carried out in different directions without a fixed pattern of wheelings being established. *Abbr.* **RTF**; *See also* **controlled traffic farming**

real time kinematic

a system that uses a fixed ground station to measure satellite drift accurately and send a correction signal by radio directly to GPS-equipped vehicles ♦Unlike satellite-based correction systems RTK is not affected by atmospheric interference and as a result can give high and repeatable accuracy. *Abbr.* **RTK**

real-time

processing, updating and acting on data as soon as it is received from a source such as a sensor

real-time agronomy

the use of constantly updated data from a source such as a sensor to inform decision-making while working, for example decisions on application rates

real-time mapping

the production of a map by processing and updating data as soon as it is received, for example as a sprayer shows where it has sprayed

real-time measurement

the acquisition and processing of data while working, allowing decision-making to take place in the field, for example sensing the crop canopy, calculating an appropriate nitrogen rate and adjusting it on the move

real-time monitoring

the acquisition and processing of data while working, allowing decision-making to take place in the field

reflectance radiometry

the measurement of electromagnetic radiation, including visible and invisible light waves, reflected from an object ♦ Reflectance radiometry is used for remote sensing of soil and crop characteristics.

reflectance sensor

a sensor that measures the amount of a type of light such as infrared light reflected from an object

reflectance spectrum

the part of the electromagnetic spectrum that is reflected by various materials, which reflect and absorb different wavelengths differently ♦ Remote sensors can form images by detecting the solar radiation reflected from different objects or parts of objects on the ground.

reflectance technology

See reflectance radiometry

remote sensing

the process of detecting information about a field, soil or crop from a distance, using sensors mounted on satellites, aircraft or tractors etc.

remote sensor

a device that collects and processes the visible and invisible light reflected from an object or area ♦ There are passive sensors, in which the energy that is radiated comes from an external source such as the sun, and active sensors that produce their own energy source.

repeatability

the ability of a positioning system to return to the same spot later on ♦ Because of drift, a vehicle may find itself 0.5-1.5 metre out in as little as an hour, depending on the static accuracy of the equipment. RTK is a system that does not suffer from drift and so has good repeatability.

resolution

the quality of detail that can be seen in an image ♦ The smaller the area represented by a pixel in a digital image, the more accurate and detailed the image is.

RTF

See random traffic farming

RTK

See Real Time Kinematic

RTK accuracy

the highest level of positioning offered by a GPS system, ± 2 cm ♦ This system requires a base station (on a tripod or building), with a dGPS receiver and radio transmitter, to get a very local correction signal,

accurate to a few centimetres. The base station can transmit to multiple vehicles up to five or six miles away depending on the terrain. *Also called* **high-level accuracy**; *See also* **real time kinematic**

RTK guidance

the use of a positioning system with an RTK correction signal to increase the accuracy of working to ± 2 cm. *See also* **real time kinematic, guidance**

SAR

See Synthetic Aperture Radar

satellite

See geostationary
telecommunications satellite, satellite constellation

satellite constellation

a set of satellites orbiting the Earth and working together to give maximum coverage of its surface
♦Global navigation satellite systems are based on radio signals sent out by sets of linked satellites. These satellites rise and set like the sun, contributing to some of the positional errors in the signals.

satellite radar sensing

a means for the rapid monitoring of very large areas using a radar signal transmitted from a satellite ♦The signal is not affected by bad weather or light conditions.

satellite-mounted sensor

a remote sensor on a satellite that can capture large amounts of data over a large area quickly

scanning radiometer

a system consisting of lenses, moving mirrors, and solid-state image sensors used on satellites that produces observations of Earth and its atmosphere by converting reflected radiation into digital images

scanning radiometry

See scanning radiometer

scouting

1. quickly defining the boundary of a field or feature using GPS equipment
2. passing through a crop to record characteristics such as disease incidence or crop development by eye. *Also called* **crop scouting**

semi-variogram

See variogram

sensor

a device that produces an electrical signal in response to a stimulus such as light or ultrasound. *See also* **remote sensor**

sensor technology

See remote sensing

shoot density

the number of stems per unit area

simple ratio index

an indicator of relative growth based on the proportion of infrared to red light reflected from a crop *Abbr.* **SRI**; *See also* **vegetation index**

single-frequency receiver

a radio receiver that uses the L1 frequency band to receive satellite positioning data

site-specific farming or management

See precision farming; *See also* spatially selective treatment

smart sensor

a sensor that can monitor its own operation and compensate for changes in operating conditions ♦For example, a group of smart sensors located throughout a field can be used to measure soil moisture in real time and transmit the results to a control system for irrigation. *Also called* **intelligent sensor**; *See also* **nanosensor**

smoothing

a statistical technique for transforming raw data that has been collected into a map ♦For example, raw yield data contains errors associated with the equipment used and smoothing helps to remove such errors to give a more accurately representative yield map. *See also* **kriging**

soil compaction

See compaction

soil conductivity

See electrical conductivity

soil electroconductivity

See electrical conductivity

soil horizon

a horizontal layer in the soil that differs in its physical characteristics from layers above or below it

soil hydrology

the characteristics of soil in relation to the content and movement of water

soil map

a plan of soil characteristics such as texture or fertility, created from a set of samples taken across an area at different depths

soil mapping

the production of a map of a field showing differences in soil characteristics such as texture or fertility that can be used, for example, to apply fertiliser only where it is needed and in appropriate amounts ♦The production of a soil map can help to reduce the high cost of fertiliser application while maintaining or even increasing yields. *Also called* **nutrient mapping**; *See also* **grid sampling**

soil sampling

taking small amounts of soil from a site to analyse composition, nutrient content or condition

soil sensing

the measurement of soil characteristics by remote sensing techniques

soil testing

the analysis of soil samples to establish composition or nutrient content

soil texture map

a plan of soil type, created from a set of samples taken across an area at different depths or inferred from an EMI scan

soil variability

differences in soil type and fertility across an area, as a result of previous cropping patterns, fertiliser use, underlying soil texture or compaction

spatial application technology

the use of data collection devices such as remote sensors to establish which areas within fields and crops need a specific treatment and then deliver site-specific treatment to that area

spatial distribution

the way in which objects or features are located in an area relative to other objects or features; they may be evenly dispersed, randomly dispersed or aggregated (clumped together) ♦Information on the spatial distribution of crop plants, weeds, diseased areas and soil types, for example, may be turned into maps on which site-specific treatments can be based. *See also* **weed aggregation**

spatial dynamics

the changes occurring in the distribution of measurements or observations over time

spatial information

the association of measurements or observations with position in a field. *Also called* **geographic information**

spatial mapping

the production of a field map by associating data on factors such as soil fertility or crop health with field position

spatial resolution

the spacing between the points at which measurements or observations

were taken in a field ♦The closer the sampling points are to one another, the higher the spatial resolution.

spatial variability

the range of difference occurring in factors such as soil composition, crop yield or insect population according to position in a field

spatially selective treatment

the application of different rates of seed, fertiliser, or agrochemicals to soil or plants in different parts of a field, according to need ♦Herbicide may be applied only to patches of weeds on the basis of a weed map, or fertiliser to specific parts of a field on the basis of a nutrient map. *Also called* **site-specific treatment**

spatially variable application or spatially variable management

See spatially selective treatment

spectral band

a set of wavebands in the electromagnetic spectrum. *See also* **hyperspectral reflectance spectroscopy**

spectral reflectance

the proportion of energy reflected by a surface at each wavelength in the electromagnetic spectrum. *See also* **hyperspectral reflectance spectroscopy**

spectral reflectance signature

See spectral signature

spectral response pattern

See spectral signature

spectral signature

the characteristic pattern of electromagnetic radiation reflected by a specific object or area. *Also called* **spectral response pattern, spectral reflectance signature**; *See also* **hyperspectral reflectance spectroscopy**

spectrometer

a device that collects and processes discrete wavelengths of radiation reflected from an object or area. *See also* **hyperspectral reflectance spectroscopy**

spectroradiometer

a device that collects radiation reflected from an object or area in wavebands rather than in discrete wavelengths

sprayer auto-shut-off

a system that allows sections of a spray boom to be turned on and off automatically, based on the GPS position as the sprayer crosses the field. *See also* **auto section control**

SRI

See simple ratio index

static accuracy

the accuracy of a positioning signal over 24 hours shown on a target map resembling an archery target where the variation from a true position (the centre point) is marked. *Also called* **long-term accuracy**; *See also* **pass-to-pass accuracy**

steering guidance system

See guidance

sub-metre accuracy

accurate location by GPS to less than one metre

submetric signal

a GPS signal that gives location accuracy of less than one metre. *See also* **sub-metre accuracy**

Synthetic Aperture Radar

a type of radar that produces a high-resolution image of the ground by collecting the echoes of many radar signals along a flight path ♦ It can be used to detect features such as soil moisture and crop development. *Abbr.* **SAR**

target map

a circular diagram resembling an archery target on which the variation of a GPS position from a true position (the centre point) is marked. *See also* **static accuracy**

telematics

the use of telecommunications technology to deliver and store information about the operation of tractors and combines

telemetry

technology that facilitates remote monitoring and measurement

terrain compensation

in a guidance system, automatic adjustments for the rolling, pitching or yawing of vehicles on sloping ground

textural analysis

See textural image analysis

textural or texture image analysis

the characterisation of regions in a digital image by their texture, allowing, for example, the different leaf types of cereals and weeds to be distinguished

threshold value

the maximum desirable, allowable or possible level

track width

the distance between the centres of wheels or tracks on the same axle

tractor-mounted sensor

a remote sensor attached to a tractor that captures data in close proximity to it with good resolution

traffic lane

a compacted strip of soil created by a single vehicle wheel or track

tramlines

parallel lines on the ground created by the wheels or tracks of a vehicle, usually the tracks made by a sprayer or fertiliser spreader

treatment map

a plan that defines where the areas of a field to be treated and the application rate that should be used ♦A treatment map can be used to control, for example, a seed drill, a fertiliser spreader or a sprayer to deliver site-specific treatment.

ultrasonic sensor

See ultrasound sensor

ultrasound sensor

a sensor that locates the presence or distance of an object or the ground by bouncing an ultrasound wave off it ♦Such sensors are often used to measure the height of a boom in automatic systems.

uniform rate technology

the application of a single rate of seeds, fertilisers or agrochemicals

across a whole field. *Abbr.* **URT**; See also **variable rate technology**

variability

the range of difference occurring in a soil, crop or other factor

variable rate application

the application of seeds, fertilisers or agrochemicals at different rates as required by the conditions in different parts of a field. *Abbr.* **VRA**

variable rate input

the use of different rates of fertilisers or agrochemicals in different parts of a field ♦For example, fertiliser application can be increased early in the season exactly in those areas where plant density is low in order to build an optimum leaf canopy.

variable rate technology

the devices enabling the differential application of fertilisers or agrochemicals in different parts of a field, according to an application map or real-time sensor. *Abbr.* **VRT**; See also **uniform rate technology**

variably-applied inputs/nitrogen

See variable rate input

variogram

a statistical method for analysing the relationships between all possible pairs of measurements taken in different places; there is a decreasing correlation as the distance between the locations increases. It is used in advanced soil sampling. ♦A semi-variogram uses each data pair only once.

VBS

See virtual base station

vegetation index

a scale that indicates relative growth and/or vigour of green vegetation, based on a ratio and/or linear combination of measurements of reflected light in the red and near-infrared regions of the spectrum.

Abbr. VI; See also normalised difference vegetative index

VI

See vegetation index

VI map

a plan of a field produced using a vegetation index

virtual base station

in a GPS system, a mobile receiver that acts as a temporary base station within its zone. *Abbr. VBS*

virtual reference station

in a wide-area differential GPS system, a position for which locational corrections are predicted, based on calculations from a network of base stations and the user's position. *Abbr. VRS*

virtual road

a guidance display that mimics the effect of driving along the centre line of a road

visible band reflectance

the reflection of light in the visible wavelengths of the spectrum from an object or area ♦Visible band reflectance in a crop gives an estimate of the green area index.

visible red

light in the red wavelengths of the spectrum which can be seen by the human eye

vision-guided hoe

See guided hoe

VRT

See variable rate technology

WAAS

See Wide Area Augmentation System

WADGPS

See wide-area differential GPS

WDRVI

See wide dynamic range vegetative index

weed aggregation

the appearance of weeds growing in patches rather than spread evenly across a field

weed map or weed patch map

See weed mapping

weed mapping

the production of a plan showing where agronomically important weeds are located in a field ♦Many such weeds are distributed in patches, and the production of a weed map potentially allows targeted treatment with herbicides.

weighcell

a fast, accurate electronic weighing device, used for example in fertiliser spreaders, telescopic handlers and weighbridges

Wide Area Augmentation System

a system developed by the US government that uses a network of ground stations to measure small variations in satellite signals and produce a correction signal, giving positional accuracy of below one metre. This feature should be disabled in the UK. *Abbr. WAAS*

wide dynamic range vegetative index

an enhancement of the normalised difference vegetation index under conditions of moderate to high biomass that applies a weighting to the near infrared reflectance values.

Abbr. **WDRVI**

wireless sensor

a remote sensor that does not require a cable connection except for power.

See also remote sensor

wide-area differential GPS

any positioning system that enhances GPS accuracy over a very large geographical area such as a continent.

See also **EGNOS, WAAS**

within-field variation

See in-field variation

yield map

See yield mapping

yield mapping

the process of using GPS and yield monitoring data to show the variation in yield across a field ♦Yield maps offer the possibility of identifying factors that vary across a field and potentially limit yield. Yield differences can then be addressed by applying treatments at different rates in different areas or by adjusting fertiliser rates to match previous crop off-take.

yield monitor

a device on a combine harvester that measures crop yield against field position

yield variation

differences in yield across a field in any one year, or from year to year

Precision farming technology and practices have gained widespread acceptance in recent years, as developments in technology have brought rapid change to farm machinery, communications and data collection. It has also introduced a new set of acronyms, buzz words and jargon, which can be confusing even to experienced farmers and growers.

Aimed at anyone involved in modern crop production, HGCA has published this complete 'Plain English' glossary that briefly and clearly defines many of the new and more familiar relevant technical precision farming terms and acronyms in an accessible 'A-Z' format.

Acknowledgements

This glossary was funded by HGCA as a knowledge transfer project to accompany the HGCA 'Be PRECISE' campaign. It was researched and written by Susan Jellis, Folia Partners Ltd.

HGCA is grateful to many people who have commented on draft versions of the glossary, including: Ian Beecher-Jones, BeecherJones Limited; Andrew Cragg; Dr Clare Kelly, HGCA; David Purdy, John Deere Ltd.

Edited by Steven Burgner, HGCA.
Design: GWS Ltd.
Photographs: AGCO, New Holland Agriculture & John Deere Ltd

Disclaimer

Great effort has been made to ensure this glossary is accurate and comprehensive. However, if any relevant detail has been omitted or any corrections are needed please do not hesitate to forward details to beprecise@hgca.com and HGCA will update the electronic version of this document as soon as possible.

HGCA has provided funding for projects on which this glossary is based but has not conducted the research or written the text. While the authors have worked on the best information available to them, neither HGCA nor the authors shall in any event be liable for any loss, damage or injury howsoever suffered directly or indirectly in relation to the glossary or the research on which it is based.

Reference herein to trade names and proprietary products without stating that they are protected does not imply they may be regarded as unprotected and thus free for general use. No endorsement of named products is intended, nor is any criticism implied of other alternative but unnamed products.

An electronic version can be downloaded at www.hgca.com/publications or www.hgca.com/beprecise
Printed on material containing at least 80% recycled content.