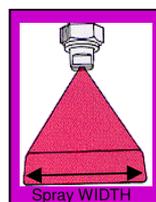


## CALIBRATION OF HAND-OPERATED SPRAYER

Accurate calibration is an essential part of every spraying operation to ensure that the pesticide is applied at the rate specified on the product label. The objective of a calibration procedure is to measure and adjust the liquid output of the sprayer and the area covered so as to conform with the product label recommendation.

Calibration Procedure Steps	SPEED –WIDTH-OUTPUT METHOD TO CALCULATE THE SPRAY VOLUME RATE	Example
Select NOZZLE		D/2.5/1.0 deflector
Set PRESSURE	Adjust pressure relief valve to appropriate position, if fitted.	“LO”
Measure TIME per 100 metres	Determine time taken to spray over 100 metres. Wear PPE and work on similar ground to that to be sprayed.	95 seconds
Calculate SPEED	$SPEED (km/h) = 360 \div TIME (seconds)$	$360 \div 95 = 3.8 km/h$
Measure WIDTH	Spray over dry surface at consistent height. Measure distance across spray band = WIDTH.	1.7 metres
Measure FLOW RATE	Spray into a bucket for 1 minute. Decant into a measuring jug for accuracy. Check all nozzles. Reject if more than $\pm 5\%$ from average.	2.2 litres/min
Calculate SPRAY VOLUME RATE	$VOLUME (l/ha) = 600 \times FLOW RATE (l/min) \div WIDTH (metres) \div SPEED (km/h)$ . If the calculated spray volume is outside the label range, adjust speed or pressure to change by up to 10%. If more required, then change the nozzle.	$600 \times 2.2 \div 1.7 \div 3.8 = 204 \text{ litres / ha}$

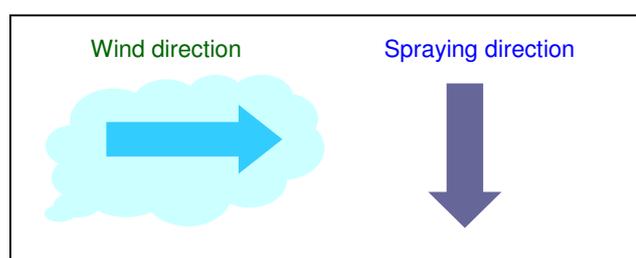


## BEST PRACTICES FOR PESTICIDE APPLICATION

### Consideration for Spraying

A.) Before spraying, check wind speed and direction to avoid spray drift.

- Avoid spraying on warm sunny days ie calm or light air or windy days.
- Ideal spraying—light breeze ie leaves rustle and wind felt on face.
- Walking direction should be across the wind direction.
- Avoid spraying just before rain is expected ie dark clouds or immediately after a downpour.
- Do not apply pesticides without adequate training.



## B) Carrying the Sprayer

- Where possible, stand a heavy knapsack sprayer on a suitable waist high bench and from there, lift it carefully onto your back.
- If no bench is available, get help from another co-worker.
- Do not attempt to lift the sprayer from the ground as it may cause spillage from the lid and may lead to back injuries.
- \* Do not use leaky or defective equipment.

## C) Application

- \* Wear the recommended protective equipment correctly before any application.
- \* Do not spray or dust into the wind. Wind can cause drift by blowing it away from the target and it may be hazardous if it drifts onto the operator, other crops, water bodies or animals.
- \* Do not apply pesticides when it is likely to rain. Some are easily washed off by rain and need a rain free period after application to be effective—the product label will indicate where this is so.
- \* Avoid use of pesticide near wells, ponds and watercourse as this will lead to contamination of the environment.
- \* Do not work in strong winds.
- \* Keep all people and animals away. Never leave pesticides and dirty equipment unattended. Never leave pesticide containers open.
- \* Collect up all wastes such as empty packages or washing waste for safe disposal,.
- \* Observe re-entry period as stated on the label. For some pesticides, there must be a time interval between treatment and re-entry to allow residues to diminish to an acceptable level and prevents the risk of contamination by working in or walking through a treated crop. If none is provided, always wait at least 24 hours after the last application.

## D) After Application

- \* Wash all equipment after use ie rinse at least three times with appropriate PPE. Any waste collected from washing should be properly disposed off.
- \* Clean and check equipment at the end of usage. Pay particular attention to thorough cleaning if the equipment is not to be used again for some time—residual pesticide may cause corrosion and clogging.
- \* Wash all clothing after each day's use.

## E) Pre-harvesting Interval

- \* Where applicable, the product label will specify the period which must elapse between the last treatment and harvesting of the crop. This period must be strictly observed, in order to ensure that pesticide residues on the crop are within acceptable limits.

## F) Disposal of Waste

- \* After application, any waste product or containers or equipment must be emptied and cleaned. Follow safety precautions when handling any pesticide waste.

## Chapter 10 GLOSSARY OF TERMS

<b>ABIOTIC</b>	Related to non-living factors, such as air pollutants, wind, water, and temperature
<b>ABSORPTION</b>	The movement of a chemical through roots/leaves into plants.
<b>ACARICIDE</b>	A pesticide used to control mites and ticks. A miticide is a type of acaricide.
<b>ACIDIC</b>	Having a pH less than 7.
<b>ACTIVATED CHARCOAL</b>	A finely ground charcoal that adsorbs ( Like magnet and iron ) chemicals.
<b>ACTIVE INGREDIENT</b>	The chemical or chemicals in a product responsible for pesticidal activity.
<b>ACUTE TOXICITY</b>	An injury produced from a single exposure. LD <sub>50</sub> and LC <sub>50</sub> are common indicators
<b>ADJUVANT</b>	A substance added to a pesticide to improve its effectiveness or safety; same as additive. Examples: spreader-stickers and wetting agents.
<b>ADSORPTION</b>	The process whereby chemicals are held or bound to a surface by physical or chemical attraction. Clay and high-organic soils tend to adsorb pesticides.
<b>AEROSOL</b>	A chemical stored in a container under pressure. An extremely fine mist is produced when the material, dissolved in a liquid, is released into the air.
<b>ALGAE</b>	Relatively simple plants that are photosynthetic and contain chlorophyll.
<b>ALGAECIDE (ALGICIDE)</b>	A pesticide used to kill algae.
<b>ALKALINE</b>	Having a pH greater than 7; also called basic.
<b>ANNUAL</b>	A plant that completes its life cycle in one year.
<b>ANTAGONISM</b>	The reduction of pesticide activity when two or more different pesticides are mixed together.
<b>ANTIBIOTIC</b>	Chemical produced by a microorganism that is toxic to other microorganisms. Examples: streptomycin and penicillin.
<b>ANTICOAGULANT</b>	A chemical that prevents normal blood clotting; the active ingredient in some rodenticides.
<b>ANTIDOTE</b>	A practical treatment used to counteract the effects of pesticide poisoning or some other poison in the body.
<b>ARTHROPOD</b>	An invertebrate animal characterized by a jointed body and limbs and usually a hard body covering that is molted at intervals. Insects, mites, and crayfish are arthropods.
<b>AVICIDE</b>	A chemical used to kill or repel birds.
<b>BACTERIA</b> (singular: <b>BACTERIUM</b> ):	Microscopic organisms, some of which are capable of producing diseases in plants and animals.
<b>BACTERICIDE</b>	A chemical used to control bacteria
<b>BAIT</b>	A food or other substance used to attract a pest to a pesticide or a trap.

## Guidelines for the use of pesticides

<b>BENEFICIAL INSECT</b>	An insect that is useful or helpful to humans. Examples are pollinators, parasites, and predators of pests.
<b>BIENNIAL</b>	A plant that completes its life cycle in two years.
<b>BIOLOGICAL CONTROL</b>	The control of pests using predators, parasites and disease-causing organisms. It may be naturally occurring or introduced.
<b>BIOPESTICIDE</b>	A pesticide derived from naturally occurring microorganisms.
<b>BOOM</b>	A pesticide application device attached to a truck, tractor, aircraft, or other vehicle, or held by hand, to which multiple spray nozzles are attached.
<b>BRAND NAME</b>	The registered or trade name, number, or designation given to a specific pesticide product or device by the manufacturer or formulator.
<b>BROADLEAF PLANTS</b>	Plants with broad, rounded, or flattened leaves with netted veins. Examples: Heliconias and roses. Different from the narrow, blade-like leaves with parallel veins such as grasses, sedges, rushes and onions.
<b>BROAD-SPECTRUM PESTICIDE</b>	A pesticide that is effective against a wide range of pests.
<b>CARBAMATES</b>	A group of pesticides commonly used for control of insects, mites, fungi, and weeds. N-methyl carbamate insecticides, miticides, and nematicides are cholinesterase inhibitors.
<b>CARCINOGEN</b>	A substance or agent able to produce malignant tumors (cancer).
<b>CARRIER</b>	An inert liquid, solid, or gas added to an active ingredient to make a pesticide formulation. A carrier is also the material, usually water or oil, used to dilute the formulated product for application.
<b>CERTIFIED APPLICATOR</b>	A person qualified to apply or supervise the application of restricted-use pesticides.
<b>CHEMICAL NAME</b>	The technical name of the active ingredient (s) found in the formulated product. This complex name is derived from the chemical structure of the active ingredient.
<b>CHLORINATED HYDROCARBON</b>	A pesticide containing chlorine, carbon and hydrogen. Many are persistent in the environment. Examples: chlordane, DDT, methoxychlor. Also called <b>ORGANOCHLORINES</b> . <b>Most of them are banned.</b>
<b>CHOLINESTERASE</b>	A chemical enzyme found in humans and many other animals that regulates the activity of nerve impulses by deactivating the chemical neurotransmitter acetylcholine.
<b>CHRONIC TOXICITY</b>	The ability of small amounts of pesticide from repeated, prolonged exposure to cause injury. (See <b>ACUTE TOXICITY</b> .)
<b>COMMON NAME</b>	A name given to a pesticide active ingredient by a recognized committee on pesticide nomenclature. Many pesticides are known by a number of trade or brand names, but each active ingredient has only one recognized common name. Example: the common name for Sevin insecticide is carbaryl.
<b>COMPATIBLE</b>	When two or more chemicals can be mixed together without reducing the effectiveness or characteristics of any individual chemical in the mixture, they are said to be compatible.

## Guidelines for the use of pesticides

<b>CONCENTRATION</b>	The amount of active ingredient in a given volume or weight of formulated product.
<b>CONTACT EFFECTS</b>	Injury at the point of contact, including skin discoloration and irritation (dermatitis) such as itching, redness, rashes, blisters, and burns. Also, swelling, stinging, and burning of the eyes, nose, mouth or throat are contact effects.
<b>CONTACT PESTICIDE</b>	Any pesticide that controls pest organisms upon contact. These may be insecticides, miticides, fungicides, or herbicides.
<b>DANGER—POISON</b>	The signal word associated with pesticide products classified as highly toxic. This signal word is also associated with pesticide products that are corrosive or highly irritating to skin and eyes
<b>DAYS TO HARVEST</b>	The minimum number of days permitted by law between the last pesticide application and the harvest date. Same as <b>PREHARVEST INTERVAL</b> .
<b>DERMAL TOXICITY</b>	The ability of a pesticide to cause injury to a human or animal when absorbed through the skin.
<b>DILUENT</b>	Any inert liquid, solid, or gaseous material that is combined with a pesticide active ingredient during the manufacturing process. Also, the water, petroleum product or other liquid in which the formulated product is mixed before application. Also referred to as the <b>CARRIER</b> .
<b>DOSE, DOSAGE</b>	The quantity of pesticide applied to a given site or target.
<b>DRIFT</b>	The airborne movement of a pesticide spray, dust, particle, or vapor beyond the intended contact area.
<b>DUST</b>	finely ground, dry pesticide formulation containing a small amount of active ingredient and a large amount of inert carrier or diluent such as clay or talc.
<b>EMULSIFIABLE CONCENTRATE</b>	A pesticide formulation produced by mixing an active ingredient and an emulsifying agent in a suitable petroleum solvent. When it is added to water, a milky emulsion is usually formed.
<b>EMULSION</b>	A mixture of two liquids that is not soluble in each another. One is suspended as very small droplets in the other with the aid of an emulsifying agent. Example: emulsifiable concentrate in water.
<b>ERADICANT</b>	A chemical or other agent (steam, heat) used to eliminate an established pest from a plant, animal, or specific site (soil, water, buildings).
<b>EXPOSURE</b>	Unwanted contact with pesticides or pesticide residues by people, other organisms, or the environment.
<b>FOLIAR</b>	Refers to pesticide applications to the leaves of plants.
<b>FORMULATION</b>	The pesticide product as purchased, containing a mixture of one or more active ingredients, carriers (inert ingredients), and other additives diluted for safety and ease of application.
<b>FUMIGANT</b>	A pesticide that forms gases or vapors toxic to plants, animals, and microorganisms.
<b>FUNGICIDE</b>	A chemical used to control fungi.
<b>GRANULE</b>	A dry pesticide formulation. The active ingredient is either mixed with or coated onto an inert carrier to form a small, ready-to-use, low-concentrate particle that does not normally present a drift hazard. Pellets differ from granules only in their precise uniformity, larger size, and shape.

## Guidelines for the use of pesticides

<b>HAZARD</b>	The likelihood that injury or death will occur from a given level and duration of exposure to a toxic chemical.
<b>HERBICIDE</b>	A pesticide used to control weeds.
<b>HOST</b>	A plant or animal on or in which a pest lives and feeds.
<b>INERT INGREDIENTS</b>	Inactive materials in a pesticide formulation that do not possess pesticidal activity, although some inert ingredients may be toxic or hazardous to humans.
<b>INSECTICIDE</b>	A pesticide used to control or prevent damage caused by insects and related arthropods.
<b>INSECTS</b>	Arthropods characterized by a body composed of three segments and three pairs of legs.
<b>INTEGRATED PEST MANAGEMENT (IPM)</b>	The use of all suitable pest control methods to keep pest populations below the economic injury level. Methods include cultural practices; use of biological, physical, and genetic control agents; and the selective use of pesticides.
<b>INVERTEBRATE</b>	A class of animals that lack backbones. Insects, spiders, nematodes, and snails and slugs are examples of invertebrates.
<b>LABEL</b>	All printed material attached to or part of a pesticide container. The label is a legal document.
<b>LARVAE</b> (singular: <b>LARVA</b> )	Immature forms of insects that undergo complete metamorphosis: developmental stages are egg, larva, pupa, and adult.
<b>LARVICIDE</b>	A pesticide used to kill insect larvae. Commonly used to control mosquito and black fly larvae.
<b>LC<sub>50</sub></b>	The concentration of a pesticide, usually in air or water, which can kill 50 percent of a test population of animals. LC <sub>50</sub> is usually expressed in parts per million (ppm). The lower the LC <sub>50</sub> value, the more toxic the chemical.
<b>LD<sub>50</sub></b>	The dose or amount of a pesticide that can kill 50 percent of the test animals when eaten or absorbed through the skin. LD <sub>50</sub> is expressed in milligrams of chemical per kilogram of body weight of the test animal (mg/kg). The lower the LD <sub>50</sub> value, the more toxic the chemical.
<b>LIFE CYCLE</b>	The series of stages that an organism passes through during its life. Many pest species, both plants and animals, pass through several life stages during which their susceptibility or tolerance to pesticides varies greatly.
<b>MATERIAL SAFETY DATASHEET (MSDS)</b>	A safety data sheet available from the manufacturer that provides information on chemical properties, toxicity, first aid, hazards, personal protective equipment, and emergency procedures to be followed in the event of a spill, leak, fire, or transportation crisis.
<b>MITE</b>	A small arthropod similar to an insect but with eight legs, two body parts and no antennae.
<b>MITICIDE</b>	A pesticide used to control mites. Same as <b>ACARICIDE</b> .
<b>MODE OF ACTION</b>	The way in which a pesticide exerts a toxic effect on the target plant, animal, or microorganism.
<b>MOLLUSCICIDE</b>	A chemical used to control snails and slugs.

## Guidelines for the use of pesticides

<b>NEMATOCIDE</b>	A pesticide used to control nematodes
<b>NEMATODES</b>	Microscopic, colorless, worm-like animals that live as saprophytes or parasites. Many cause diseases of plants or animals.
<b>NOXIOUS WEED</b>	A plant defined by law as being particularly troublesome, undesirable, and difficult to control.
<b>NYMPH</b>	The developmental state of insects with gradual metamorphosis that hatches from the egg. Nymphs become adults.
<b>ORALTOXICITY</b>	The occurrence of injury when a pesticide is taken by mouth.
<b>ORGANOPHOSPHATES</b>	A large group of pesticides that contain the element phosphorus. Most are non-persistent insecticides, miticides, and nematocides. Many are highly toxic. Examples: malathion, parathion, diazinon, chlorpyrifos.
<b>PARASITE</b>	A plant, animal, or microorganism living in, on, or with another living organism for the purpose of obtaining all or part of its food.
<b>PATHOGEN</b>	A disease-causing organism
<b>PELLET</b>	A pesticide formulation consisting of dry active and inert ingredients pressed into a uniformly sized and shaped ready-to-use material; larger than granules.
<b>PERENNIAL</b>	A plant that lives for more than two years.
<b>PERSISTENT PESTICIDE</b>	A pesticide chemical (or its metabolites) that remains active in the environment more than one growing season. Some compounds can accumulate in animal and plant tissues or remain in the soil for years e.g. Organochlorine insecticide.
<b>PERSONAL PROTECTIVE EQUIPMENT (PPE)</b>	Devices and clothing that protect pesticide applicators, handlers, and workers from exposure to pesticides.
<b>PEST</b>	An undesirable organism (insect, bacterium, fungus, nematode, weed, virus or rodent) that is injurious to humans, desirable plants and animals, manufactured products, or natural products.
<b>PESTICIDE</b>	Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.
<b>PEST RESISTANCE</b>	The ability of an insect, fungus, weed, rodent, or other pest to tolerate a pesticide that once controlled it.
<b>pH</b>	A measure of acidity/alkalinity; acid below pH7, basic or alkaline above pH 7.
<b>PHEROMONE</b>	A substance emitted by an animal to influence the behavior of other animals of the same species. Some are synthetically produced for use in insect traps.
<b>PHYTOTOXICITY</b>	Chemical injury to plants.
<b>PISCICIDE</b>	A chemical used to control pest fish.
<b>PPM</b>	Parts per million. One part per million equals 1 mg in one litre.

## Guidelines for the use of pesticides

<b>PREDATOR</b>	An animal that attacks, kills and feeds on other animals. Examples of predaceous animals are bears, wolves, coyotes, hawks, owls, snakes, fish, spiders, and many insects and mites.
<b>PROTECTANT</b>	A pesticide applied to a plant or animal before infection or attack by the pest to prevent infection or injury by the pest.
<b>PUPA</b>	The developmental stage of some insects between larva and adult.
<b>QUARANTINE</b>	A regulatory method to control the introduction and dissemination of plant and animal pests into new areas. Involves inspections, treatments, and destruction of contaminated plants/animals or their parts.
<b>REGISTERED PESTICIDES</b>	Pesticide products that have been registered by the Environmental Protection Agency for the uses listed on the label.
<b>REPELLENT</b>	A compound that keeps insects, rodents, birds, or other pests away from plants, domestic animals, buildings, or other treated areas.
<b>RESIDUAL PESTICIDE</b>	A pesticide that continues to remain effective on a treated surface or area for an extended period following application.
<b>RESISTANT</b>	A population of organisms that are uninjured or unaffected by a certain dosage of pesticide chemical used to successfully control other populations of the same organism. Also, plants and animals that are unaffected by a pest species. (See <b>TOLERANT</b> .)
<b>RODENTICIDE</b>	A chemical used to control rodents
<b>RUN OFF</b>	The movement of water and associated materials on the soil surface.
<b>SHELF LIFE</b>	The maximum period of time that a pesticide concentrate can remain in storage before losing some of its effectiveness.
<b>SIGNALWORDS</b>	Words that are required to appear on every pesticide label to denote the relative acute toxicity of the product. The signal words are DANGER—POISON used with a skull and crossbones symbol for potentially lethal products, DANGER for severe skin and eye damage, WARNING for moderately toxic, or CAUTION for slightly toxic compounds.
<b>SOLUBILITY</b>	The ability of a chemical such as a pesticide to dissolve in a solvent, usually water.
<b>SOLUBLE POWDER</b>	A finely ground dry pesticide formulation that will dissolve in water or some other liquid carrier.
<b>SPRAY DEPOSIT</b>	The amount of pesticide chemical that remains on a sprayed surface after the droplets have dried.
<b>SPREADER</b>	An adjuvant used to enhance the spread of a pesticide over a treated surface, thus improving the coverage.
<b>STABILITY</b>	Refers to the ability of a chemical such as a pesticide to resist breaking down into metabolites. A highly stable pesticide can be stored for long periods without loss of activity.
<b>STICKER</b>	An adjuvant used to improve the adherence of spray droplets to a plant, animal, or other treated surface.

<b>STOMACH POISON</b>	A pesticide that must be eaten by an animal to be effective—it will not kill on contact.
<b>SUSPENSION</b>	A pesticide mixture consisting of fine particles dispersed or floating in a liquid, usually water or oil. Example: wettable powders or flowables in water.
<b>SYNERGISM</b>	The effect of two or more pesticides applied together that is greater than the sum of the individual pesticides applied separately. Example: Pesticide X kills 40 percent of an insect population; Pesticide Y kills 20 percent. When applied together, X and Y kill 95 percent.
<b>SYSTEMIC EFFECTS</b>	Poisoning effects that occur at sites other than the entry point into the body.
<b>SYSTEMIC PESTICIDE</b>	A chemical that is absorbed and translocated within a plant or animal.
<b>TERMITICIDE</b>	An insecticide used to control termites.
<b>TOLERANCE</b>	The maximum amount of a pesticide residue that may legally remain on or in food or feed commodities at harvest or slaughter.
<b>TOXICANT</b>	A poisonous substance such as the active ingredient in a pesticide formulation.
<b>TRADE NAME</b>	A brand name that is registered as a trademark by the manufacturer.
<b>ULTRA-LOW VOLUME (ULV)</b>	Sprays that are applied at 0.5 gallon or less per acre, often as the undiluted formulation.
<b>UNCLASSIFIED PESTICIDES</b>	Pesticides that are commonly referred to as general-use pesticides. They can be bought and used by the general public without special permits or restrictions.
<b>VECTOR</b>	An animal (e.g., insect, nematode, mite) or plant (e.g., dodder) that can carry and transmit a pathogen from one host to another.
<b>VERTEBRATE</b>	An animal characterized by a segmented backbone or spinal column.
<b>VIRUS</b>	Ultramicroscopic parasites. Viruses can multiply only in living tissues and cause many animal and plant diseases.
<b>WARNING</b>	A signal word used on pesticide products that are considered moderately toxic; these pesticides have an oral LD <sub>50</sub> between 50mg/kg and 500mg/kg or a dermal LD <sub>50</sub> between 200 and 2,000mg/kg.
<b>WEED</b>	A plant growing where it is not wanted or where it is in direct conflict with the well-being of humans and their activities.
<b>WETTABLE POWDER</b>	A dry pesticide formulation in powder form that forms a suspension when added to water.
<b>WETTING AGENT</b>	An adjuvant used to reduce the surface tension between a liquid and the contact surface for more thorough coverage