

## Technical Bulletin #30:

# Agrochemical Application Procedures

For many reasons, farmers do not fully understand the correct way to apply agrochemicals, which can lead to problems for the users, the crops, and the environment.

Therefore, it is extremely important to understand the basics of agrochemicals and their proper use.

### The Pest/Disease Management Cycle

1. First you have to assess the farm situation. Is there really a problem?
2. Assuming there is; what can be done? What are the options?
3. The next step is to decide the correct course of action. For example, with weeds, depending on their number, their stage of growth, and the stage of growth of the crops, you can either:
  - Do nothing
  - Manually weed
  - Mechanically weed
  - Or apply an agrochemical - in this case a herbicide
4. If the decision is made to spray, then the right product has to be used and the application has to be made safely and effectively



### When to Apply Agrochemicals:

Applying agrochemicals depends on what problem we are trying to solve. Generally for fungal problems and applying foliar fertilizers, we work with a predetermined spraying program on a weekly basis. For controlling bacterial and pest (insect) problems, we apply according to the situation.

Before any decision is made, we have to know what problem we are trying to control. Is it a fungal, bacterial or insect problem? Is it really a problem that requires an agrochemical? What is the level of infestation, is it restricted to one part of the farm, is the problem severe, moderate or slight? This information will come from a survey or a random sample of your farm. From this survey you can determine if you need to apply an agrochemical, which chemical to apply, when to apply it, the correct dosage to use, and the correct frequency of spray applications. This type of information and decisions come with experience and takes time to understand, which means that you have to have good technical training in order to make the correct decisions.

### Spraying Equipment to use:

Depending on the type of product you are going to apply, stage of the crop development, size of the farm, and type of problem you are going to solve, you have several options. The most common are:

1. Back pack sprayers. They work with air pressure (15 psi) using a manual pump and their tank capacity can range from 2 to 20 liters. Small capacity sprayers (2 to 6 liters) are ideal for small nurseries when

plants are young (seedling trays) and for small area home gardens. Larger capacity sprayers are considered commercial for larger farms.

2. Mist blowers. The main difference from the back pack sprayer is the pressure that is delivered, which can go as high as 30-50 psi, providing better coverage of the foliage (higher pressure resulting in smaller droplets), and is also ideal for fruit trees.
3. Irrigation systems. There are some products that can be applied through irrigation systems, like soil insecticides, and soluble fertilizers. This is a very cheap way to apply chemicals but its use is restricted to a few products for controlling specific soil insects (larva) and certain soil-borne pathogens.
4. Manual application of baits. This is dangerous, takes a lot of time, and is expensive; not recommended.



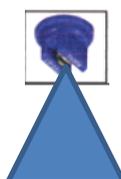
### **Factors Affecting a Good Application:**

1. Applicator experience:
  - Has to know what the problem is.
  - Where the pests or diseases affect the crop; stem, foliage (top or underside of the leaf), root system, etc.
  - Has to be well trained.
  - Has to know the basics of agrochemical use and composition.
  - Has to know how much water to apply per area and how much product is required.
  - Has to be aware of weather conditions and their influence on the application.
  - Has had training in the safe use and handling of pesticides and their potential negative effect on humans and the environment.
2. Mixing conditions:
  - Water pH - most commonly between 5.0 to 6.0, if not otherwise stated on the label.
  - Bicarbonates - If the water contains excessive bicarbonates the water will remain at alkaline levels, which is too high of a pH to be compatible with many agrochemicals.
  - Water impurities - silt and other impurities can degrade the agrochemical very fast.
  - Temperature - temperatures too high or too low can reduce the mixing compatibility of some products.
3. Volume of water used:
  - Very young crops need little volume, but at fully mature stage they may need three to four times the volume. The volume of water to be used is directly related to the volume of foliage of the crop. The fewer the plants, the smaller the volume of water needed (tomatoes would need more volume than lettuce because of the amount of foliage needed to be covered by the spray application).

- The type of weed, pest, or disease.
4. Adjusting spray volume:
- Speed (motorized sprayers) - doubling the speed reduces by half the amount of volume applied per area, which has a direct effect in volume delivered.
  - Nozzle type - the type and size of the nozzle aperture (opening) also has a direct effect in volume delivered.
  - Pressure - for doubling volume output requires four times as much pressure, which has a proportional effect on volume delivered.
5. Weather conditions:  
Rain, wind, and temperature have a direct effect on application effectiveness.
- Applications are best made in the mid to late afternoon, although wind is often a problem.
  - The secondary preferred time is early mornings.
  - Note that some products require sunlight, so check the label for specific instructions.
6. Equipment:  
The maintenance of your equipment is extremely important. For an effective application, you have to check your equipment for the following situations:
- Leaking, low pressure, dripping nozzles, and problems with protective gear (clothing).
  - Clean your equipment every time you finish an application, wash it with water and detergent (triple rinse).
  - Check the nozzles. The pattern is important. If you see the pattern is different from when the nozzle was new, it means that the nozzle is clogged or worn out and has to be replaced.



Cone-type nozzle, good for spot applications.



Flat fan-type nozzle, the most common nozzle, very good for band applications.

**Calibration:**

1. Define the volume to apply according to the crop and stage of development.

Recommended Liters of Water per hectare

Days After Transplant	Cabbage, Lettuce, Mustard	Onions	Pumpkin, Gourds, Cucumber	Peppers, Tomato	Longbean
3	100	100	100	100	100
12	200	250	200	200	200
19	300	350	300	300	300
26	400	400	400	400	400
33	500	500	500	500	500
40	600	550	600	600	600
60	600	550	600	600	600



2. Measure the operating speed (e.g., time to cover 100 meters) under conditions typical of field application conditions.
3. Measure the output in a given time (e.g., 5 minutes).
4. Change the nozzles or sprayer to make the applicator speed at the required volume.
5. Assign one sprayer to one applicator.

### **Tank Mixing:**

Step 1 - Check water pH. If above 6.0, you have to lower it to between 5.0 and 6.0, unless otherwise stated.

Step 2 - Place about 1/3 of the needed water into the tank.

Step 3 - Use a measuring cup to determine the required amount of pesticide and add the required amount of pesticide for one tank load as recommended from the pesticide label.

Step 4 - Add the remaining volume of water needed. Use only clean water to prevent clogging of the nozzle and the sprayer flow lines.

Step 5 - If available, add a spreader/sticker product.

Step 6 - Cover tightly and shake the tank to mix thoroughly.

Never leave a chemical mixture for the next day. Our recommendation is to use it in a period not longer than two hours after mixing the chemicals.

When mixing different chemicals we have to be careful to do it in the right order. Otherwise, we can end up with an insoluble mix that cannot be sprayed. The recommended mixing order is:

1. Water soluble bags.
2. Dry formulations.
3. Water based liquid flowables and suspension concentrates.
4. Emulsifiable concentrates.
5. Surfactants.
6. Water based solutions and water liquids, liquid fertilizers, and micronutrients.

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