**Plant growth stages for proper herbicide timing**

Sherrilyn Phelps, M.Sc., PAg., CCA,
Agronomy and Seed Program Manager, Saskatchewan Pulse Growers

Herbicides and fungicides are safe and most effective when applied at appropriate growth stages. In order to make informed decisions on whether the crop or weed is at the right stage to spray, growers must understand the structures of the plants and how they develop. Vegetative stages are defined by the number of leaves produced on the main stem and the number of tillers on a plant (cereals and annual grasses), or number of nodes on a plant (broadleaf plants). Leaf stages are defined by the number of leaves on the main stem only. A leaf is counted as complete when it is at least one-half the length of the leaf below it.

To stage a crop, one must assess at least 10 plants at random. Some people use a hat thrown into a field to pick plants, others use the location of the toe of their boot. Random selection gives you the best indication of plant staging.

Grassy weeds such as wild oat and green foxtail, as well as volunteer cereals, produce one leaf at a time. The first leaf sheath also encloses all later leaves and makes it easier to separate out tillers from actual leaves. A new leaf is produced every four to five days, usually reaching a total of eight or nine leaves, depending on maturity. Tillers are the secondary stems of a grass plant and will emerge from the axil of the leaf. It is enclosed at the base by a sheath called a prophyll. Tiller one emerges from the first leaf, tiller two from the second leaf, and so on.

**Image 1:** Leaf and tiller staging of grasses.
*Source: 2015 Guide to Crop Protection, Saskatchewan Ministry of Agriculture*
Labels of herbicide products may refer to leaf stage and tiller stage or total leaf count. Total leaf count refers to the total number of leaves on the entire plant, including tillers. Most product labels refer to main stem leaves and tillers.

Broadleaf crops and weeds are much more straightforward than grasses or cereal grains. The first leaves that appear with most broadleaf crops are called the cotyledons. These are not true leaves and are often shaped different. The first true leaves appear after the cotyledons. Leaf staging can be confusing when more than one leaf is produced at the growing point depending on the type of leaf arrangements. Plants with alternate leaves produce one leaf at a time while plants with opposite leaves produce two leaves at the same time. Whorled leaf arrangements can produce more than two leaves at a time.

To simplify staging of broadleaves, there is another term called node staging. With broadleaf plants the growing points above the cotyledons where the leaves emerge are called nodes. True leaves originate from these node positions, and for alternate leaf arrangements, the number of leaves equal the number of nodes as there is only one leaf per growing point. With opposite leaves the node stage is usually half the leaf stage, as two leaves are produced at each growing point.

![Image 2: Leaf arrangements and staging of broadleaf weeds and crops.](Image 2)  
Source: 2015 Guide to Crop Protection, Saskatchewan Ministry of Agriculture

Some crops, such as pea, lentil, chickpea, and faba bean germinate with the cotyledons remaining below ground. This means the first growing points or nodes are produced below ground and as the plants grow, those growing points can move above ground. The first two nodes do not contain true leaves in these crops but produce scale leaves that are not counted in the leaf staging. Labels often refer to above ground node stage or true leaf staging.
Image 3: Lentil seedling, node, and leaf stages

Image 4: Pea seedling, node, and leaf stages

Image 5: Faba bean seedling, node, and leaf stages

Image 6: Chickpea seedling, node, and leaf stages
Other legume crops such as dry bean and soybean germinate with cotyledons moving above ground. The first true leaves are single opposite leaves called unifoliate leaves, and these are located at the first node. All later leaves have three leaflets, called trifoliolate leaves, and are located on alternate sides of the stem. See Table 1 for crop stages with dry bean and soybean.

Recognition of plant growth stages is critical for effective weed control and crop safety. Read labels carefully so that you ensure the product is being applied at the safest stage for the crop and the most effective stage for the weeds.