Preharvest herbicide use in dry edible beans: Function, timing, and rotation restrictions are important to consider when selecting a herbicide

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Over the next 2 ½-months many Michigan dry bean fields will be treated with preharvest herbicides. Preharvest herbicides, also known as “Harvest Aids”, are used to desiccate or dry down “green” stem and leaf tissue that can hinder dry bean harvest. The main intention of preharvest herbicide applications is to desiccate weeds; however many growers use these herbicide applications to hurry along or even out the maturing process of dry beans. Currently in Michigan, there are four different herbicide options labeled for preharvest applications in dry beans. These herbicides are Gramoxone SL 2.0 and other formulations of paraquat, glyphosate (Roundup and several other formulations), Valor 51WG (flumioxazin), and Sharpen 2.85L (saflufenacil). Differences in these products include the speed of activity, recropping restrictions, and effectiveness. Understanding the strengths, weaknesses, and restrictions of each of these products will be important in selecting the herbicide that best fits your operation. If the guidelines below are not followed yield can be reduced, rotational crops can be injured, and illegal herbicide residues (i.e., glyphosate) can be found in the marketed product. Below are the benefits and use precautions for herbicides that can be used for preharvest herbicide applications in dry beans.

Gramoxone SL 2.0 (paraquat) was one of the first products registered as a harvest aid in dry beans. The primary use of Gramoxone is to desiccate uncontrolled weeds that may interfere with harvest. However, Gramoxone will also help desiccate dry beans that may have some green leaves or stems. In MSU trials, Gramoxone has been one of the herbicides with of the quickest speed of activity, showing greater control of weeds and desiccation of dry beans at 3 days after treatment than glyphosate or Valor. However, by 7 days after treatment dry bean desiccation with Valor and 14 days after treatment weed control and dry bean desiccation with glyphosate (Roundup) have been similar to Gramoxone. Gramoxone is a contact herbicide so desiccation is dependent on good spray coverage. The use rate of Gramoxone is 1.2 to 2 pt/A. In MSU trials we have generally applied 2 pt/A. A non-ionic surfactant (NIS) at 0.25% v/v must be applied with Gramoxone. The application timing for Gramoxone is when the dry bean crop is mature, at least 80% of the pods should be yellowing and mostly ripe and no more than 40% (bush-type beans) or 30% (vine-type beans) of leaves still green. Gramoxone can be applied as a split application if weed and dry bean growth is lush and vigorous, but the total application rate cannot exceed 2 pt/A. There is a 7 day preharvest restriction between application of Gramoxone and dry bean harvest. Gramoxone is also a restricted-use pesticide, so a private or commercial pesticide applicator’s license is required for use of this product. There are no crop rotation restrictions with Gramoxone.
**Glyphosate** (Roundup PowerMax and several other formulations) provides the most consistent and effective weed control of the preharvest herbicides labeled for use in dry beans. However, glyphosate is the one product that if not used properly can lead to illegal residues in the marketed product and has led to buyers rejecting dry bean exports. To avoid illegal residues, glyphosate applications need to be made to dry beans after they are in the **hard dough stage** (30% seed moisture or less). Additionally, in MSU trials we have also observed a loss of black color in canned black beans if preharvest applications of glyphosate are made too early. While the intentions of most growers are to make these applications according to the label, the unevenness in dry bean maturity of some varieties makes it difficult to have an entire field all at the same stage for preharvest herbicide applications. In these cases, growers should either wait until the entire field of dry beans is in the **hard dough stage** (30% moisture or less) or they should consider using a different product. The maximum use rate of glyphosate as a preharvest treatment is **0.75 lb a.e./A** (equivalent to 22 fl oz/A of Roundup PowerMax). Not all glyphosate products are registered for preharvest use in dry beans, so it is important to consult product labels for legal applications. We recommend to always include 17 lbs of ammonium sulfate (AMS) per 100 gallons of spray solution for applications of glyphosate. Remember there is also a **7 day preharvest** interval for glyphosate. Glyphosate provides the slowest activity of all the preharvest herbicides labeled and it generally takes 7 to 14 days after treatment for complete weed and dry bean desiccation. There are no crop rotation restrictions with glyphosate.

**Valor 51WG** (flumioxazin) has provided similar desiccation of dry beans as Gramoxone, by 7 days after treatment in several MSU trials. However, weed control has not been quite as effective. There is not an initial application timing listed on the label, but I would recommend using similar guidelines as Gramoxone. These guidelines are when the dry bean crop is mature, at least 80% of the pods are yellowing and mostly ripe and no more than 40% (bush-type beans) or 30% (vine-type beans) of leaves still green. Valor should be applied at 1.5 to 2.0 oz/A with 1 qt/A of a methylated seed oil (MSO). In MSU trials, **1.5 oz/A of Valor with MSO** has provided similar desiccation as 2 oz/A of Valor. Dry beans can be harvested within **5 days** of application, but in MSU trials it generally takes 7 to 14 days after treatment to reach maximum dry bean desiccation. Depending on your crop rotation, the **residual activity** of Valor activity can be a draw back or benefit. If your intended rotation is corn or soybean Valor can provide some residual control of winter annual weeds prior to planting these crops. However, if you are planning on planting **winter wheat** after a desiccation application of Valor there needs to be **1 month** and **1-inch of rain** before planting this crop. For sugar beets the labeled rotation restriction is 4 months if the soil is tilled and 8 months if the soil is not tilled with a bioassay using a maximum application rate of 2 oz/A of Valor. There have been some concerns with these rotation restrictions prior to planting sugar beet. We have conducted two years of research that looked at planting of sugar beet following Valor desiccant applications to dry bean. In our research we have observed reductions in sugar beet stand that were not reflected in yield or recoverable white sugar when the tilled rotation restriction was followed. Even though we have not observed a reduction in sugar beet yield, I would still caution growers when using Valor as a desiccation treatment prior to planting sugar beets. If a grower intends to plant sugar beets after Valor has been used as a desiccant treatment, a successful soil bioassay planted with sugar beet needs to be conducted and tillage is essential. Even with tillage there is a high probability that sugar beet stand may be reduced. Another thing to keep in mind is Valor residues can be trapped.
in poly-tanks and hoses if the spray equipment is not adequately cleaned. There are special sprayer cleanup procedures listed on the label. It is important to follow these procedures, so there is not a problem with tank-contamination in the following spray loads.

**Sharpen 2.85L** (saflufenacil) is the newest herbicide labeled for use as a harvest aid in dry edible beans and has been an effective dry bean desiccant in MSU trials and grower fields. Sharpen has similar speed of activity as Gramoxone and is quicker than glyphosate and Valor. Sharpen is a contact herbicide so desiccation is dependent on good spray coverage. Sharpen can be applied at rates up to 2 fl oz/A. However, in MSU trial 1 fl oz/A of Sharpen with **MSO (1% v/v) + AMS** has provided similar desiccation as 2 fl oz/A, so we recommend the 1 fl oz/A rate. The application timing for Sharpen is when the dry bean crop is mature, at least 80% of the pods should be yellowing and mostly ripe and no more than 40% (bush-type beans) or 30% (vine-type beans) of leaves still green. There is a 2 day preharvest restriction between application of Sharpen and dry bean harvest, however it generally takes 7 days to reach maximum desiccation activity. Crop rotation should also be considered when using Sharpen as a preharvest herbicide. Winter wheat can be planted immediately after dry bean harvest. However, if rotating to sugar beet special precautions need to be taken. The **rotation restrictions** for sugar beet are 4 months for a 1 fl oz/A application rate of Sharpen and 5 months for a 2 fl oz/A rate, this excludes months where the ground is frozen. So in many cases if you are rotating to sugar beet you should consider using Gramoxone or glyphosate. Furthermore, there still a few MRLs (maximum residue levels) not established for export of dry beans to Taiwan and only MRLs are established for kidney beans for export to Korea.

**Combinations of different preharvest herbicides:** Several growers have felt that they have had better results with combinations of the aforementioned harvest aid products. In MSU trials we have rarely observed a benefit to these combinations for dry bean desiccation. However, if weeds are a problem the addition of glyphosate or Gramoxone to either Valor or Sharpen would improve weed desiccation. Remember if one chooses to use a combination of any of these products it is important to follow use precautions of the most restrictive product.