ROUNDUP POWERMAX TRIALS USING BACKPACK AND MISTBLOWER SPRAYERS.

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Introduction: NC Fraser fir Christmas tree growers have been suppressing weeds with Roundup Original for close to a decade. Ground covers around trees dominated by white clover have become the norm. Benefits include cooler soils, nitrogen fixation, suppression of problem weeds, and habitat for beneficial insects and wildlife such as quail. It has become a source of pride for both individual growers and our industry.

Of course, just as we get used to doing things one way, it changes. With competition from a plethora of generic formulations of glyphosate, Monsanto changed the formulation of Roundup they produce. The new PowerMAX formulation has benefits of rapid weed foliage penetration and increased rain fastness. However, any formulation change could alter its phytotoxicity to Fraser fir. To help our industry transition from old to new, Monsanto sponsored two studies to evaluate use of Roundup PowerMAX in place of Roundup Original. In 2008, PowerMAX was evaluated next to Original using conventional backpack sprayer practices. In 2009, the work also compared mistblower sprayers to backpack sprayers.

2008 Backpack Sprayer Trials: In 2008, three studies were established on farms in Ashe, Avery, and Jackson Counties to compare the two materials. The studies were conducted with a generic formula of Roundup Original and the new Roundup PowerMAX formulation provided by Monsanto. At each farm, thirty trees were treated with each herbicide along with weeds in the row middle. Lower branches were intentionally sprayed with herbicide mix. Backpack sprayer treatments were made in May, June, and July using 8 ounces of Original and 5.5 ounces of PowerMAX per acre. Damage to lower branches was evaluated three weeks later as was the level of weed suppression. Damage was recorded as number of shoots injured and the maximum length of damage observed per tree.

Similar results were observed for both materials sprayed by backpack in 2008. No damage was observed in May. In June, injury was only observed at one of the three locations possibly aggravated by operator error. Observed damage occurred on branch tips closest to where sprayer nozzles passed. Minor injury to branch tips observed in early July was similar for both Roundup Original and PowerMAX. However, the pattern of injury at each site was different. Treatments induced the same level of injury at one site, more with PowerMAX at the second site, and more with Original at the third site. This effectively cancelled out differences between the two products. Based on these results, we felt we could safely recommend substituting PowerMAX for Roundup Original.

Injured terminal from June mistblower application

2009 Mistblower Sprayer Trials: Building on the results of the 2008 backpack sprayer work, the 2009 studies incorporated both mistblower and backpack sprayer treatments. 2009 treatments were made on five farms. Blocks from one quarter to one half acre in size were used to evaluate mistblower application. Treatments were made in June and July to evaluate injury during the tender window. Rates of 4, 3, and 2 ounces of Original and 2.7, 2.1, and 1.4 ounces of PowerMAX were applied per acre with PTO-driven mistblower sprayers. Additional treatments of PowerMAX were applied only in July at rates of 2.7 and 4.1 ounces per acre. The whole tree including the leader was sprayed using mistblowers. The high rates were repeated using backpack sprayers equipped with TK nozzles. Only lower branches were sprayed with backpack sprayers. Tree injury was evaluated three weeks after treatment and again after trees were sheared. Number of shoots injured, length of damage in inches, and severity of injury was recorded. Further injury evaluations will be conducted after foliage matures in 2010.

Once again, no foliage was injured by May treatments despite onset of new growth. However, tree injury was observed in both June and July. All June and July treatments resulted in some damage. Backpack sprayer injury occurred on lower branch tips close to sprayer nozzles. Mistblower damage occurred to terminals and a few top lateral branches. Significantly more branches were injured by backpack sprayer equipped with TK nozzles than by mist-

blower. More branches were injured in 2009 with the backpack sprayer with PowerMAX than with Roundup Original.

When the length of injury was examined, no difference was observed between equal rates of Original and PowerMAX. However, there was a significant difference in rate. The lowest rate of both materials yielded shorter average lengths of injury than did the middle and higher rates of herbicide. The length of injury to terminals damaged by mistblower application was longer than that observed from backpack application. At the time of treatment, most terminals were 12 to 24 inches tall while side shoots were between 4 and 8 inches.

Figure 1 shows the percent of terminals injured before and after shearing. Equivalent rates of the two formulations of Round Up injured about the same percentage of trees. The greatest percentage of terminals injured was from the single 4.1 ounce rate of PowerMAX applied in July. Before shearing, the percentage of trees injured increased significantly with herbicide rate. After shearing, most rate differences disappeared. Only the 3 and 4 ounce rates of Original showed injury on more terminals. Much of the injury to terminals was located on the tips and was removed when the terminal was cut to proper length.

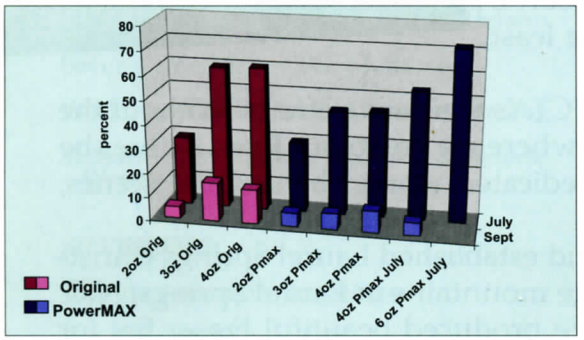

Figure 4. Percent of terminals injured by mistblower treatments before and after shearing

Figure 1. Percent of terminals injured by mistblower treatments before and after shearing

When the length of injury was examined on the basis of shearing, a rate effect was more visible after shearing than before. The low rate showed the shortest length of injury after shearing. The July-only treatments of PowerMAX showed a further decrease in the length of injury after shearing compared to June and July treatments. Presumably this occurred because the July-only injury occurred almost exclusively on the tips of terminals and was largely removed. There was no reduction in the length of damage from backpack sprayers after shearing since injured side braches did not grow long enough to be sheared.

While significantly less damage was observed at the lowest applied glyphosate rate, there is some question whether this is useful. The effectiveness of the herbicide on weed control was noticeably less at the reduced rate. At this already low range of herbicide rates, adjustments to timing or application technique may be more effective than reductions in rate. Simply waiting a few more days in July would have reduced the risk of injury from that observed in our study.

Levels of injury in these studies represent potential risk related to seasonal variations in June and July regardless of the type of sprayer. In a cool, wet year, foliage matures more slowly. The tender window may stay open longer. Needles are soft, branches droop, and bark on immature shoots remains tender. In a sunnier year, foliage grows faster and stiffens sooner. When side branches stop drooping, they are less susceptible to Roundup injury. Look for the majority of branches in the top third of the tree to be level or slightly upright in branch angle. The last branch on a Fraser fir to mature is the terminal and its susceptibility to injury may extend 2 to 3 weeks beyond the side branches.

The mistblower study results suggested that much of the damage will be sheared off leaving a majority of trees unblemished. This is true where terminals are cut, but not where trees are left with natural tops. It would be unwise to recommend mistblower application during June or early July when terminals are not cut. Growers can use backpack sprayers with safe TQ nozzles during the tender window to minimize risk. This is clearly the safest choice. Where white clover is well-established and an effective 8 ounce per acre rate was applied in mid-May, growers may have enough weed suppression to avoid a June or early July treatment all together. May or late July mistblower treatments are still safe options at calibrated rates.

In conclusion, NC Christmas tree growers have "pushed the envelope" for timing, rate, and application techniques used with Roundup over the years. The use of mistblower sprayers represents a huge savings in labor compared to backpack sprayers. For some growers, saving money justifies the risk of tree injury, but not for others. It is an individual decision that depends on scale of production, the importance a grower places on uniformity, and the nature of the grower. Growers pushed treatment limits to the point where this work was needed, and will, in all likelihood, keep pushing to find new ways to grow trees for less money.