

Chaff-Lining to Control the Seed Bank of Italian Ryegrass

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Italian ryegrass is becoming more widespread and problematic in eastern Washington wheat production areas. The reliance on postemergence herbicides coupled with outcrossing pollination has resulted in widespread Group 1 and Group 2 herbicide resistance. Alternative approaches to management other than the typical chemical and mechanical methods are needed and must be adopted to manage Italian ryegrass.

Once such alternative management method could be chaff lining. Australians have been battling the same problem for many years and have introduced the idea of Harvest Weed Seed Control (HWSC). HWSC is a group of nonchemical approaches that take advantage of the target seed retention of the plant at the maturity stage (Lyon, 2020). Chaff lining is the cheapest option in terms of capital and overall cost, compared to other options, such as hammer-mill based seed destructors. Normally, when growers harvest their wheat crop that may be infested with Italian ryegrass, the Italian ryegrass seed that is contained in the chaff is spread back into the field. That can result in the seeding of hundreds of thousands of Italian ryegrass plants per acre. Chaff lining involves a simple chute that diverts the wheat chaff that contains Italian ryegrass seed into a narrow windrow and that does not disrupt the spreading of the straw. The chaff windrow is left for the grower to decide how to dispose of the seed/chaff. Farmers have devised several methods of managing seed in the chaff row, including burning the chaff row to singe the seed, bailing of the chaff row to send the seed to an off-farm site, managing the chaff row to decompose on the spot, or ideally, implementing controlled traffic and placing the chaff row in an area of repeated traffic passes. Concentrating the chaff into narrow windrows within the field can create a hostile environment for the Italian ryegrass germination and emergence (Lyon, 2020). This can result in reduced seed production/seed bank due to the competition among the Italian ryegrass plants.



Figure 1: Successful chaff lining windrow in a winter wheat crop using a modified Case 2388 hillside combine.

Chaff lining has not been implemented by growers in eastern Washington. The most significant hurdle is mounting a chute on the back of a hillside combine, without damaging the chaff chute or combine. Additionally, there is heavy skepticism by growers that the idea to divert the target seed to the desired windrow would be successful. The chaff lining method does have some specific drawbacks. The main problem is that approximately 50% of Italian ryegrass seeds

shatter from the plant head, before the header reel even touches the plant (Mark Thorne, Unpublished Data). With a significant portion of the Italian ryegrass seed already on the ground, the impact of the management tactic may be incremental.



Figure 2: Rear view of spreader system and chute platform.



Figure 3: Side view of how the chute platform is mounted to the combine.

In the summer of 2020, a hillside combine (a Case Axial-Flow 2388 series) was modified to chaff line. The main modifications to the Case 2388 combine consisted of the addition of another straw spreader/shaft system, a baffle diverter and the chute platform.

The straw spreader/shaft system consisted of many common Case parts purchased from a local dealer. The straw spreader/shaft system was the most expensive part of the project, mainly because all the shaft parts and hardware were new. A secondary straw spreader/shaft system was necessary to not jeopardize the regular straw spreader/shaft system, in case the normal function of the combine was needed. The parts consisted of a horizontal shaft that was the width of the combine, 10-inch pulley, longer v- drive belt, shaft supports/bearings/spider gears and hardware (nuts/bolts/washers). Other parts were purchased and incorporated but may be unnecessary, such as new straw spreader cones, straw spreader fins and down shafts. The need of the secondary straw spreader/shaft system on the combine was to move the straw spreader cones back and up, so the chute platform could fit under the straw spreader/shaft system. The new straw spreader/shaft system sat 12 inches back and 4 inches up from the regular straw spreader/shaft system.



Figure 4: Modified components in the spreader/shaft-system. The drive shaft mounts were reversed, necessitating a longer drive belt for the system.

The straw baffle system consisted of one ¼-inch thick metal sheet that is mounted across the inside width of the combine and located behind the straw chopper. The baffle separates the chaff from the straw material. Coming from the straw chopper, the straw is traveling at a high velocity that goes over the top of the baffle and is flung to the back pan of the combine and then pushed out from the combine fan. The baffle then directs the chaff to the bottom pan of the combine and then to the chute. The baffle had to be bent at a certain pitch to facilitate the separation of chaff and the straw material.

Modifying the chute platform was the final and the most challenging step. The chute had to be mounted to both sides of the combine and not to the rear axle of the combine, which seemed like the most logical anchor point. The rear axle was independent of the combine, due to the leveling system. Therefore, the chute would become damaged if attached to the rear axle. Attaching the chute to the side of the combine was the best option due to the durability and stability the chute needed. Two 3' by 4' sheets were cut out from 1/8th inch sheet metal and manufactured to sit at the rear of the combine. The rectangular sheets were then bolted to independent frames that were bolted to the side of the combine. The chute mirrored the same angle of the combine when the leveling system was engaged.



Figure 5: Internal baffle that separates chaff and straw material.

Success of the Italian ryegrass seed placement from the chute is yet to be determined. The chute was modified on the combine during the summer of 2020 and tested within a spring wheat field heavily infested with Italian ryegrass. Italian ryegrass seed densities will be assessed and identified in the spring of 2021, when germination occurs. It is unknown how many Italian ryegrass seeds are contained within the chaff lining windrow. Fine tuning the efficiency of the chaff lining project is needed to characterize the success of the modifications and the chaff lining project.