

Example Onion Fungicide Program for Control of Leaf Diseases in Onion with Emphasis on Managing Fungicide Resistance and Selecting Fungicides by Disease Category in Western New York, 2021

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Table 1 shows an example of an 8-week spray program from 6-7 leaf (summer solstice) until 50% lodging (usual timing of last pesticide spray). It assumes only a 1-week ride with the momentum of Movento, and that an insecticide that is also incompatible with Bravo is used every week after that. This program does not exceed more than 3 apps per FRAC or active ingredients and never uses more than two consecutive applications per FRAC/a.i. before rotating to a different FRAC/a.i.. However, it would be preferred to not use more than 2 apps per FRAC 3, at least in Elba. SLB is certainly developing fungicide resistance to FRAC 3 in Elba, as performance of single FRAC 3 products in 2020 fungicide trial declined noticeably from prior year. Alternatively, FRAC 3 had very good activity against SLB in Oswego fungicide trial. FRAC use has varied from 1 to 5 apps of FRAC 3 per spray program across individual farms. In Elba in 2020, the majority of spray programs did not exceed 3 applications of FRAC 3. This example spray program strategically saves FRAC 3 fungicides for the end of the program for their superior ability to prevent SLB leaf dieback.

Week 1: Mancozeb for early BLB halo control. Is compatible with Movento, is affordable and has low-risk of fungicide resistance. Mancozeb at this time helps to preserve the use of SLB fungicides with higher risk of fungicide resistance for later in the season.

Week 2: Miravis Prime is best for BLB halos and has some activity on BLB necrotic spots and SLB infection. Assumption is that BLB pressure is high at this time. Also, using Miravis Prime early in the program provides more separation in time from planned later use of other FRAC 7 Luna Tranquility. If BLB halo pressure is less than 3 per leaf, then mancozeb 1-3 lb may be used.

Week 3: It is assumed that thrips are below spray threshold following second application of Movento and that **no insecticide is being applied this week. This is a great time to use Bravo**, which has a low risk of fungicide resistance, multi-site mode of action, is affordable, and is generally very good at controlling BLB halos and BLB necrotic spots. Although in previous fungicide trials, Bravo tended to be "significantly better than nothing, but not great" for SLB, in 2020 trials it was poor at reducing SLB spots and leaf tip spore colonization and failed to control SLB leaf dieback. For this reason, Gavel may be added to Bravo for extra control of SLB infections, as it appeared to reduce SLB spots and leaf tip spore colonization in 2020 Elba fungicide trial. Unfortunately, last week this tank mix did not hold back SLB in one of the scouting fields. Another option for tank mixing with Bravo for added SLB infection prevention could be Oso, which looked promising in 2020 Oswego trial for BLB halos/necrotic spots and SLB infection. Oso is more expensive than Gavel. If an insecticide application is not needed for more than two weeks, Bravo +/- Gavel/Oso could be used for each of these sprays (theoretically weeks 3 & 4).

Week 4: Scala + Rovral is placed next for its activity on BLB halos. In Elba, it is also a good choice for its activity on SLB target spots and leaf tip spore colonization. In Oswego, Scala + Rovral did not work well on SLB, in which case Oswego growers may want to switch Miravis Prime in week 2 to Scala + Rovral, and Scala + Rovral in week 4 to Miravis Prime. Alternatively, Gavel may be tank mixed with Scala + Rovral for additional activity on SLB, if needed (optional).

Week 4/5 are that mid-July/0.5-1 inch bulb timing when SLB fungicides should be initiated, if they have not been already, especially if SLB target spots have been detected.

Week 5: It is assumed that **BLB necrotic spots are becoming more dominant and SLB pressure has increased and it is time to apply a very good SLB fungicide with 3 weeks remaining in the spray program.** Where FRAC 3s are still working well, such as the site where the 2020 Oswego trial was located, Inspire Super seems to be a good fit in this time slot. Alternatively, in Elba, where FRAC 3s have definitely slipped in their activity against SLB, Inspire Super is not such a great idea. Instead, Scala + Rovral may be saved for this time slot. This could be accomplished if Bravo was used for two consecutive weeks following Movento, or by stretching the spray interval from 7 to 10 days to eliminate a spray between weeks 3 and 5, provided disease pressure and disease categories match up with these suggestions. If only 3 weeks are left in the spray program, you could roll right into week 6.

Week 6: This is the **beginning of the home stretch where the emphasis is now on using products with best activity on preventing SLB leaf dieback.** In this first spray of the home stretch, Luna Tranquility + Rovral is used because it has good activity on BLB halos and BLB necrotic spots. If Miravis Prime was used in week 2, this is 4 weeks between applications of FRAC 7, and they belong to different subclasses (just in case rotating subclasses may reduce development of fungicide resistance to FRAC 7(4) in Miravis Prime). Also, in Luna Tranquility + Rovral combination, FRAC 7(1) is "double-guarded" with FRACs 9b and 2.

Week 7 & 8: FRAC 3 Viathon 3 pt/A +/- FRAC 3 Tilt 8 fl oz is the best for keeping foliage green to ensure onions lodge properly and do not die standing up. FRAC 3 + 3 is essentially a way of using a high rate of FRAC 3, which will protect against fungicide resistance. Theoretically, the **double rate of FRAC 3 would ensure that any SLB isolates that may have developed resistance to any single FRAC 3 will be killed by this potent combo halting development of resistance in its tracks.** In Elba 2020 fungicide trial, Viathon alone was green as Quadris Top + Tilt and Luna Tranquility + Rovral, while Viathon + Tilt was significantly greener. Viathon alone could be used interchangeably with Quadris Top + Tilt.

Weeks 6 and 7 may be applied in reverse order. If pressure appears to be high in week 6, start with Viathon + Tilt. If after first Viathon + Tilt, there is only one spray left, you can skip Luna Tranquility + Rovral altogether.

In Elba where over 2000 acres of onions are grown in a single pocket of muck with fields maturing from mid-July until early September, it is likely that SLB spores are moving from field to field as they are harvested. In this case, if each field finishes its spray program with FRAC 3s, the SLB population in Elba may potentially be exposed to more than just 2 applications of FRAC 3 as the spores move from field to field. **In early-maturing varieties when SLB pressure is still fairly low and risk of excessive leaf dieback and dying standing up is low as onions mature in July, growers may want to consider skipping FRAC 3s in these fields altogether.**

Table 1. Example onion fungicide program for control of leaf diseases in onion with emphasis on managing fungicide resistance and selecting fungicides by disease category.

Week No.	Approx. Date	Crop Stage	Insecticide for Thrips	Fungicides	BLB ¹ Halos	BLB Necrotic Spots	SLB ² Target/Tip Colonization	SLB Leaf Dieback	DM ³	FRAC ⁴ Group
1	Jun 21	6-7 leaf	Movento	Mancozeb 1-3 lb	VG	Fail-P	Fail-P	Fail	yes	M03
2	Jun 28	7 leaf pre-bulb	Movento	Miravis Prime 11.4 fl oz	VG-E	F-P	G-VG	G-VG (Oswego) F (Elba)	no	7(4) + 12
3	Jul 5	8 leaf 0.5" bulb	---	Bravo 3 pt	VG	G	P	Fail-P	no	M05
			optional	+ Gavel 2 lb	na	G	VG	Fail	yes	22 + M3
4	Jul 12	8-10 leaf 0.5-1" bulb	Yes	Scala 9 fl oz	VG	F	VG (Elba)	VG (Elba)	no	9a
			Yes	+ Rovral 1 pt	VG	F	P-Fail (Oswego)	P-Fail (Oswego)	no	2
			optional	+ Gavel 2 lb	na	G	VG	Fail	yes	22 + M3
5	Jul 19	8-10 leaf 1-1.5" bulb	Yes 3rd FRAC 3	Inspire Super 20 fl oz	Fail	VG	VG-G (Oswego) P (Elba)	G (Oswego) Fail (Elba)	no	3b + 9b
6	Jul 26	8-10 leaf 2" bulb Start lodge	Yes	Luna Tranquility 16 fl oz	VG	G	F-P	VG-E	no	7(1) + 9a
			Yes	+ Rovral 1 pt	VG	G	F-P	VG-E	no	2
7	Aug 2	8-10 leaf 2+" bulb 25% lodge	Yes	Viathon 3 pt	na	na	G	E-VG	yes	3c + P07
			optional	+ Tilt 8 fl oz	na	na	G	E-VG	no	3a
8	Aug 9	8-10 leaf 2-3" bulb 50% lodge	Yes	Viathon 3 pt	na	na	G	E-VG	yes	3c + P07
			optional	+ Tilt 8 fl oz	na	na	G	E-VG	no	3a

Relative Performance: E=Excellent; VG=Very Good; G=Good; F=Fair; P=Poor; Fail

1 BLB: Botrytis leaf blight

2 SLB: Stemphylium leaf blight

3 DM: Downy mildew

4 FRAC codes. Different numbers in brackets following FRAC 7 represent active ingredients that belong to different sub-classes of FRAC 7. It is possible that SLB may vary in its ability to develop resistance to fungicides belonging to different sub-classes. Although it appears that cross resistance among FRAC groups is occurring. The letters a, b and c following the FRAC 3 codes indicate different active ingredients. All of the fungicides belonging to FRAC 3 that are labeled in onion are in the same sub-class, but there could be slight differences among active ingredients in SLB's ability to develop resistance to them. Total applications with FRAC 3 = 3. Total applications with FRAC 7 = 2. Total applications with FRAC 9 = 3.