Controlling tar vine (*Boerhavia coccinea*): an emerging summer weed in the Western Australian Wheatbelt

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Key messages

- Tar vine is a tough summer weed and was not effectively controlled by most knockdown herbicides when applied alone.
- Glyphosate alone or as tank mix with Starane® Advance, 2, 4-D ester or Tordon® provided 93% to 100% control of tar vine at Mullewa but their efficacy was lower at Jennacubbine.
- Double knockdown of glyphosate alone or as tank mix with phenoxy herbicides followed by paraquat based knockdowns effectively controlled this weed.
- The double knockdowns that controlled tar vine also effectively controlled caltrop, roly-poly, Afghan melon, and red pigweed but not goosefoot. The only double knockdown that highly effectively controlled goosefoot was glyphosate + Tordon® followed by Spray.Seed®.

Aims

Tar vine (*Boerhavia coccinea*) is an emerging summer weed in the northern, central and southern agriculture regions of Western Australia. It emerges in spring to early summer, grows vigorously depleting moisture and nutrients from the soil profile which can potentially reduce the yield of the following winter crop.

There is lack of lack of information on the efficacy of herbicides that can reliably control this weed. If tar vine is not sprayed at seedling stage, then this weed may grow profusely to a diameter of 0.5 m or greater, producing large number of primary and secondary branches and numerous seed heads. While tar vine usually dies off with the advent of winter the biomass produced by this weed during summer fallow may have some adverse impact on winter crop. The alleloptahy of this weed species on winter crops is yet unknown.

While it is important to determine the efficacy of herbicides to control this summer weed, there is little information available on the efficacy of herbicides to control tar vine during summer fallow and its effect on the growth of winter grain crops.

The aim of the trial was to examine the efficacy of herbicides to control tar vine during 2015 summer fallow under hot and harsh conditions at Mullewa (northern agriculture region) and Jennacubbine (central agriculture region).

Method

Field Trial at Mullewa (Trial 1)

Trial 1 was conducted in a paddock with wheat stubble from February to March, 2015 at Mullewa that received 26 mm rain in February and 125 mm in March (10 mL on 1/3/2015, 51 mm on 2/3/2015 and 62 mm on 14/3/2015). Twenty two herbicides either alone, in sequence or as tank mixes (Figure 1) were sprayed on 26/2/2015 (34.5 ^{o}C) followed by the second spray (in case of double Knockdowns) on 4/3/2015 (25 ^{o}C). An untreated control was used to compare the weed control efficacy. All the herbicides were sprayed before 10:30 am to avoid heat stress.

Herbicide efficacy was assessed visually on all weeds present on 16/3/2015 independently by two assessors. Weed control was expressed as the percentage of the untreated control. Untreated control plots were sprayed to kill all surviving plants at the end of the trial. Corner of plot one was GPS logged and could be identifiable during winter cropping season. A wheat crop was sown across all the plots by the grower. Wheat crop growth was monitored for any residual effect of summer-applied herbicides on wheat crop.

Field Trial at Jennacubbine (Trial 2)

Trial 2 was conducted from February to March 2015 in a paddock with oats stubble at Jennacubbine that received 14 mm rain in February and 32 mm rain in March and 20 mm in April (based on the nearest weather station at Grass Valley). Tar vine plants were at seedlings to rosette stages at the time of spraying. Other summer weeds such as caltrop (*Tribulus terrestris*), roly-poly (*Salsola australis*), Afghan melon (*Citrullus lanatus*), goosefoot (*Chenopodium* spp), and red pigweed (*Portulaca oleracea*) were also present at seedling to early budding stages at the time of spraying.

Twenty two herbicide either alone, in sequence or as tank mixes (Figure 2) were sprayed on 22/2/2015 (day temperature: max 36 ^{o}C and min 15 ^{o}C) followed by second spray (in case of double knockdowns) on 25/2/2015 (day temperature: max 41 ^{o}C and min 25.5 ^{o}C). An untreated control was included to compare the weed control efficacy. Herbicide efficacy on weed control for each species was assessed visually on 16/3/2015 by two independent assessors. Weed control was expressed as the percentage of the untreated control.

A wheat crop was grown across all plots of summer weed control during winter of 2015. Wheat crop was monitored at different growth stages to assess any effect of summer applied herbicides on the emergence and growth of wheat crop.

Design and analysis

Both the trials were laid out in a randomised complete block design with 3 replications in Trial 1 and 4 replications in Trial 2. The unit plot size was 20 m x 2 m in both the trials. The untreated control was replicated 9 times in Trial 1 and 12 times in Trial 2 (3 replications within each block). Data on the summer weed control percentage were subject to ANOVA and means were compared by LSD at 5%.

Results

Field Trial at Mullewa (Trial 1)

Herbicides (Spray.Seed®, glufosinate, Alliance®, Starane® Advance, amitrole, glyphosate, Tordon® 75-D, Para-Trooper®, Garlon®, and Lontrel®) applied alone during hot days of late February provided 8 to 67% control of tar vine (Figure 1). Glyphosate alone or as tank mix with Starane® Advance, 2, 4-D ester or Tordon® provided 93 to 100% control of tar vine. Double knockdowns of glyphosate alone or as tank mix with 2, 4-D ester or Tordon® followed by Spray.Seed®, Alliance® or Para-Trooper® provided 96 to 100% control of tar vine at Mullewa (Figure 1).

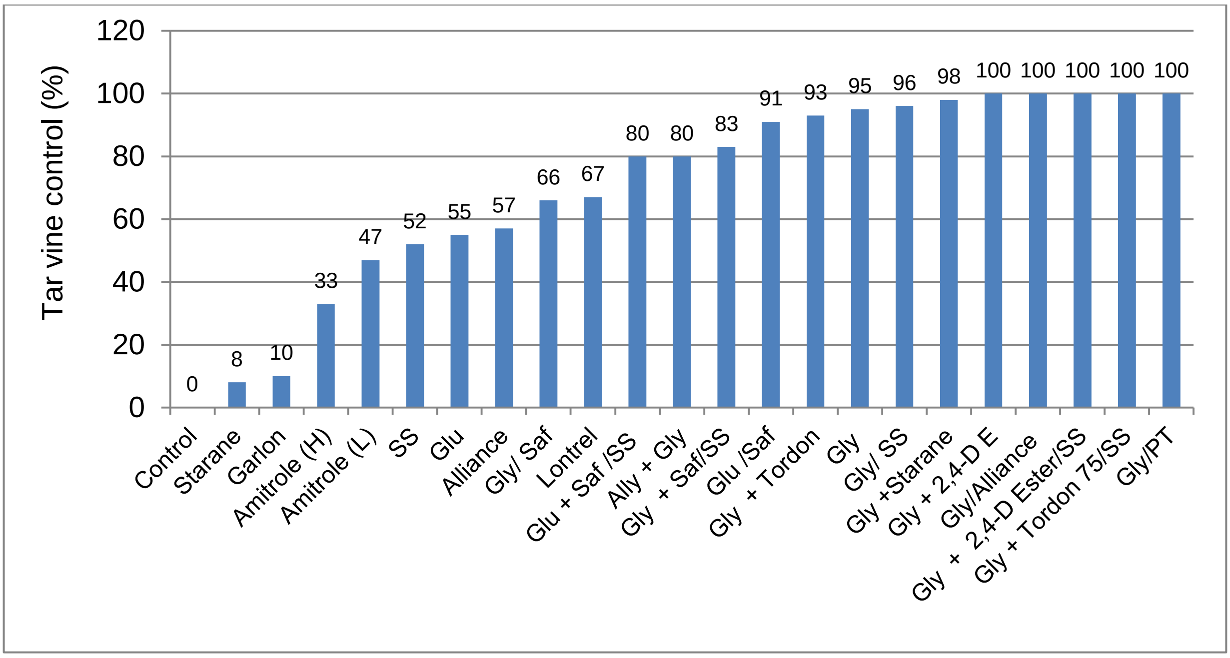

Figure 1. Effect of different herbicides on the control of tar vine during 2015 summer fallow season at Mullewa. Gly = glyphosate 540 g/L), SS = Spray.Seed® L (paraquat 135 g/L + diquat 115 g/L), Glu = glufosinate 200 g/L, Alliance® = paraquat 135 g/L + amitrole 250 g/L, Starane® Advance =fluroxypyr 333 g/L, Amitrole = amitrole 250 g/L, 2,4-D E = 2,4-D 680 g/L, Saf = saflufenacil 700 g/kg, Tordon® 75-D = 2,4-D 300g/L + picloram 75 g/L, PT = Para-Trooper® (paraquat 250 g/L + amitrole 10 g/L), Garlon® = triclopyr 600 g/L, Lontrel® = clopyralid 300 g/L, and Ally® = metsulfuron 600 g/kg; L = low, H = high; '+' indicates tank mix and '/' indicates herbicides were applied in sequence; P-value = <0.001, $LSD_{(5\%)}$ = 23.6.

Field Trial at Jennacubbine (Trial 2)

The Jennacubbine site (Trial 2) of tar vine was drier than Mullewa site during 2015 summer. Herbicides such as glyphosate, Spray.Seed®, Alliance®, Starane® Advance, Amitrole, Garlon® and Lontrel® applied alone provided 64 to 82% control of tar vine (Figure 2). Tank mix of glyphosate with saflufenacil, Starane®, Tordon® or Ally® provided 85% control of tar vine. However, double knockdowns of glyphosate alone or as tank mix with 2, 4-D or saflufenacil followed by Spray.Seed®, Alliance® or Para-Trooper® applied during the hot days of February 2015 provided 95 to 100% control of tar vine (Figure 2).

All glyphosate-based double knockdowns were highly effective on caltrop, roly-poly and Afghan melon (Table 1). These treatments were also fairly effective on red pigweed but were not effective on goosefoot except glyphosate + Tordon® followed by Spray.Seed®, although none of the components on their own of this double knockdown was effective on goosefoot. Glyphosate or glufosinate applied alone was highly effective on Afghan melon while glyphosate on its own was also effective on roly-poly (Table 1). Most of the herbicides applied alone were not effective on goosefoot and red pigweed.

Based on the assessments made on wheat crop during winter and spring of 2015, emergence and growth of wheat crop were not visually affected by any of the herbicides applied to control summer weeds. No emergence of the summer weed species found in 2015 summer was found during spring season. Windmill grass that was present in very low density during summer season was also growing through winter wheat crop in wide row plots.

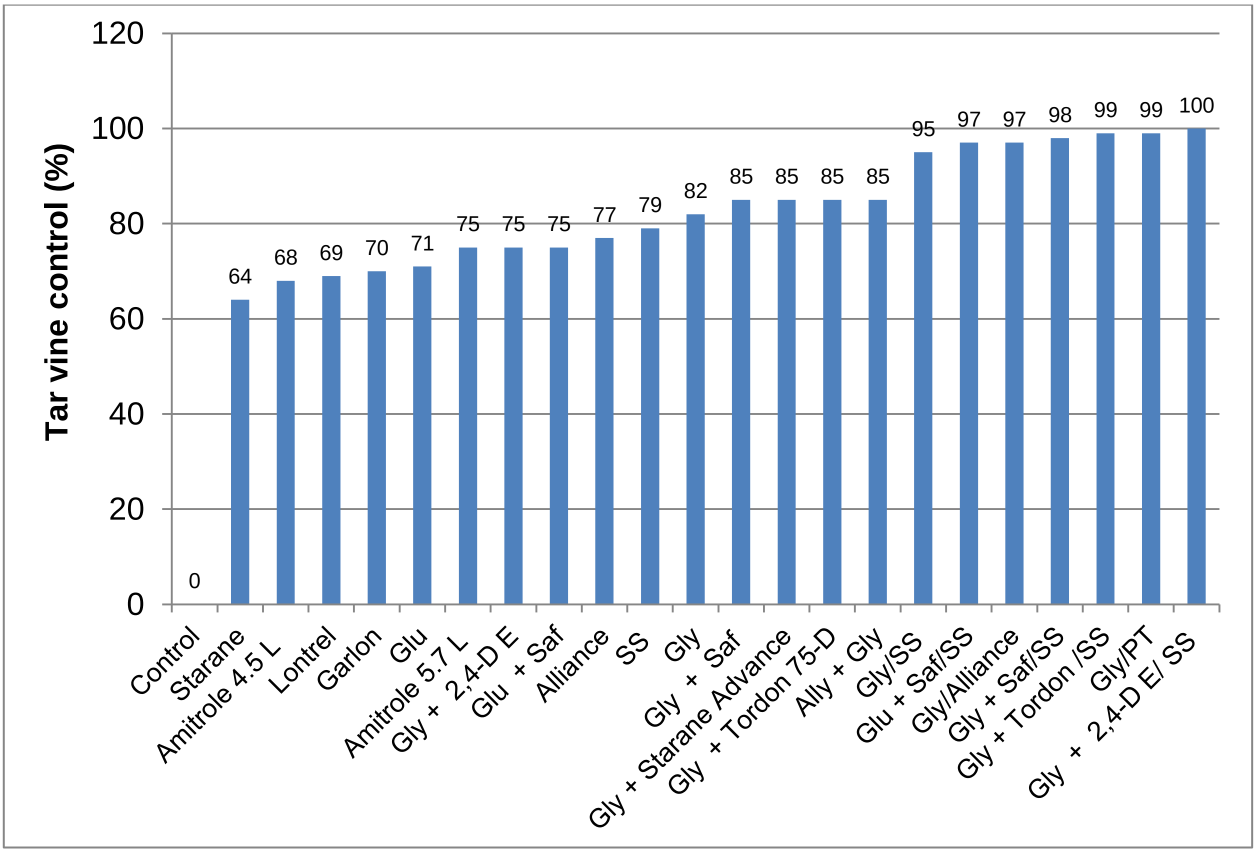

Figure 2. Effect of different herbicides on the control of tar vine during 2015 summer fallow season at Jennacubbine (Northam). Gly = glyphosate 540 g/L), SS = Spray.Seed® L (paraquat 135 g/L + diquat 115 g/L), Glu = glufosinate 200 g/L, Alliance® = paraquat 135 g/L + amitrole 250 g/L, Starane® Advance =fluroxypyr 333 g/L, Amitrole = amitrole 250 g/L, 2,4-D E = 2,4-D 680 g/L, Saf = saflufenacil 700 g/kg, Tordon® 75-D = 2,4-D 300g/L + picloram 75 g/L, PT = Para-Trooper® (paraquat 250 g/L + amitrole 10 g/L), Garlon® = triclopyr 600 g/L, Lontrel® = clopyralid 300 g/L, and Ally® = metsulfuron 600 g/kg; L = low, H = high; '+' indicates tank mix and '/' indicates herbicides were applied in sequence; P-value = <0.001, LSD(5%) = 23.6.

Table 1. Effect of different herbicides on the control of caltrop, roly-poly, Afghan melon, goosefoot, and red pigweed during 2015 summer fallow season at Jennacubbine (Northam)[1].

Treatments	Caltrop	Roly-poly	Afghan melon	Goosefoot	Red pigweed
Control (no herbicide)	0	0	0	0	0
Glyphosate	80	88	98	0	39
Spray.Seed®	57	78	38	25	23
Glufosinate	66	79	100	0	38
Alliance®	62	86	61	44	35
Starane® Advance	60	77	49	2	33
Amitrole low	61	66	0	24	54
Glyphosate /Spray.Seed	92	100	99	24	66
Glyphosate + 2,4-D Ester	75	61	100	47	34
Glyphosate + saflufenacil	84	96	67	24	29
Glufosinate + saflufenacil	75	91	98	2	46
Glyphosate + Starane® Advance	76	75	95	0	93
Amitrole high	66	47	74	24	28
Glyphosate + Tordon® 75-D	78	72	67	0	40
Glyphosate + 2,4-D Ester / Spray.Seed®	100	100	103	44	94
Glyphosate + saflufenacil /Spray.Seed®	91	100	96	64	85
Glyphosate + Tordon® 75-D /Spray.Seed®	99	100	97	100	100
Glufosinate + saflufenacil / Spray.Seed®	95	100	78	24	84
Glyphosate / Para-Trooper®	99	100	94	24	81
Glyphosate /Alliance®	94	100	98	24	48
Garlon®	57	37	76	24	23
Ally® + glyphosate	85	100	99	49	64
Lontrel®	76	75	0	24	33
P-value	<.001	<.001	<.001	<.001	<.001
LSD.05	15.53	9.24	20.29	6.65	28.1

[1] In treatment names, '+' indicates tank mix and '/' indicates herbicides were applied in sequence; herbicide active ingredients are same as in Figure 2.

Conclusion

Tar vine is a tough opportunistic summer weed. Most knockdown or phenoxy herbicides applied alone did not effectively control tar vine at Mullewa or Jennacubbine during 2015 summer. Glyphosate based tank mixes or double knockdowns appear to be more reliable control options for tar vine. However, there was a difference in control levels between the two sites, probably due to differences in site characteristics and seasonal conditions. Mullewa site was a red soil and received high rainfall (>150 mm) during summer fallow. In contrast, Jennacubbine site is sandy soil with much lower summer rainfall (<100 mm) than Mullewa. Tar vine plant size was much smaller (about 1/10th of the average plant size at Mullewa) at Jennacubbine than Mullewa. So, plants were smaller but more stressed at Jennacubbine than Mullewa while plants were too big at Mullewa, leading to a difference in the achieved levels of control of tar vine plants. Where weed control was 90% or lower, tar vine plants were found to regrow and produce flowers. Research at laboratory and glasshouse by DAFWA shows that tar vine seed has high level of dormancy. So, this weed should be controlled to prevent any seed production. Tar vine plant can produce flower within 2-3 weeks after emergence during summer time.

Key words

Tar vine, caltrop, roly-poly, Afghan melon. goosefoot, red pigweed, double knockdowns, tank mixes, summer weed control.

Acknowledgments

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