CHEMICAL BUSH CONTROL ON *RHIGOZUM TRICHOTOMUM* AND *ACACIA NEBROWNII* IN SOUTHERN NAMIBIA USING DIFFERENT ARBORICIDES AND CONTROL METHODS

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INTRODUCTION

Trials to determine the effect of the arboricides Savana SC and Molopo GG P200 on *Rhigozum trichotomum* (three-thorn rhigozum; driedoring) and *Acacia nebrownii* (water-thorn; waterdoring, slapdoring) were done on the farm Bloemhof of Ms S. Cronje, 70 kilometres southeast of Mariental. The veld type is classified as dwarf shrub savanna and the soil is calcareous in nature. The farm has an average rainfall of 130 mm per annum. *Rhigozum trichotomum* is a major problem in the southern and southeastern parts of Namibia, especially in the streets between dunes, with densities of up to 40 000 bushes/ha. In some instances thickets are formed which are virtually impenetrable to small stock and game.

Rhigozum trichotomum has a taproot, and a very shallow hair-root system. These hair-roots absorb most of the moisture during showers, and compete directly with grasses. *Acacia nebrownii* has the same kind of root system, as do all other acacias. *A. nebrownii* is more concentrated near rivers, pans, on calcareous as well as clayish soils. This species can also reach high bush densities: the higher the moisture content of the soils, the higher the densities, especially in and around pans.

The arboricides Savana SC (applied manually) and Molopo GG P200 (also applied manually, but simulating aerial application) were used. Both these arboricides effectively control most invader bush.

1. SAVANA SC (Tebuthiuron 25 % and Bromacil 25 %) on *Rhigozum trichotomum*

Date of treatment: October 2003.
Target spp.: *Rhigozum trichotomum.*
Bush density: 4 050 bushes/ha in the height class 0,5–1 m.
Area treated: 10 ha.
Treatment: 5 L Savanna was mixed with 30 L of water. The arboricide was then applied to the soil, close to the stems of bushes, at a rate of 2 ml/0,5 m bush height. Application was done by means of a syringe.
Cost: At 800 ml active/ha @ N$ 130.00/L = N$ 104.00/ha.

Botanical composition before treatment – June 2003
95 % *Rhigozum trichotomum*, 3 % *Catophractes alexandri* and 2 % *Parkinsonia africana*. The botanical composition of the area was very poor because the measured rainfall was only 81 mm for the season, with 2 % *Stipagrostis uniplumis*, 22 % annuals (mainly *Schmidtia kalahariensis*), and 76 % bare areas.

Botanical composition – 2004
49 % *Stipagrotis uniplumis* (almost 100 % of which were seedlings), 2 % *Stipagrostis ciliata*, 43 % annuals (mostly *Schmidtia kalahariensis*) and 6 % bare areas. The measured rainfall was 144 mm for the season.

Botanical composition – 2006
33 % *Stipagrostis uniplumis* (the tufts were still young but very vigorous), 5 % *Stipagrostis ciliata*, and 62 % annuals (mostly *Schmidtia kalahariensis* and *Eragrostis porosa*). The measured rainfall was 170 mm for the season, with the highest measured rainfall in February.


June 2003, before treatment


June 2006, after treatment

Botanical composition – June 2008
The vegetation improved to 65 % *Stipagrostis uniplumis*, 15 % *Stipagrostis ciliata*, 10 % *Eragrostis lehmanniana* tufts, and only 10 % annuals, mostly *Schmidtia kalahariensis*. Measured rainfall was 151 mm for the season, with the highest measured rainfall in February.

Success rate

98 % (after the 2004 survey).

Results

The grass production was measured in June 2008 by cutting 40 quadrates (1 m^2) in the treated area, and the same in the camp next to the treated area, which was untreated and served as a control.

Table 1. Comparison in dry matter (DM) production, grazing capacity and income between sites treated with Savana SC and untreated site

Site	DM production (kg/ha)	Grazing capacity (kg AB/ha)	Income/ha (N$)
Control	613	28	112.70
Treated	1 686	85	342.10

This table shows that there was a 300 % increase in grazing capacity after treatment.

June 2008, after treatment

2. MOLOPO GG P200 pellets on dominant invaders (*Rhigozum trichotomum* and *Acacia nebrownii*)

For sites 1–6:

Date of treatment: June 2005.
Target spp.: *Rhigozum trichotomum* (sites 1, 2, and 3) and *Acacia nebrownii* (sites 4, 5, and 6).
Area treated: Six 1 ha blocks were measured out. Each was divided into ten strips of 10 x 100 meter, using three 100-metre ropes, to facilitate the application of the arboricide and to simulate aerial application.
Treatment: Molopo GG P200 pellets were broadcast manually to simulate aerial control on all sites. The three *Rhigozum* and the three *Acacia* sites were treated with 2 kg/ha, 2,5 kg/ha and 3 kg/ha, respectively. The Molopo pellets were weighed in honey jars: 200 g/strip for the 2 kg/ha site; 250 g/strip for the 2,5 kg/ha site; and 300 g/strip for the 3 kg/ha site. The pellets were broadcast as evenly as possible over the 6 x 1 000 m^2 sites.
Measurement of results: Bush density and botanical composition surveys (100 points) were done before and after the treatment of all sites.

Site 1:

Target spp.: *Rhigozum trichotomum.*
Bush density: 1 350 bushes/ha in the height class 1–2 m.
Treatment: 2 kg/ha Molopo GG P200 pellets/ha or 200 g per 10 x 100 m strip.
Cost: N$ 134/ha.
Botanical composition before treatment – June 2005: 80 % annuals (mostly *Schmidtia kalahariensis*) and 20 % bare areas.
Botanical composition – June 2006: 27 % perennials (*Stipagrostis uniplumis* seedlings) and 73 % annuals (*Schmidtia kalahariensis*).
Botanical composition – June 2008: 57 % perennials (*Stipagrostis uniplumis* 47 % and *S. ciliata* 10 %), and 43 % annuals (*Schmidtia kalahariensis*).
Success rate: 56 % of *Rhigozum trichotomum* bushes were dead, while 44 % were affected but still showed signs of life.

Site 1: June 2008, after treatment

Site 2:

Target spp.: *Rhigozum trichotomum.*
Bush density: 1 400 bushes/ha in the height class 1–2 m.
Treatment: 2,5 kg/ha Molopo GG P200 pellets/ha or 250 g per 10 x 100 m strip.
Cost: N$ 167.30/ha.
Botanical composition before treatment – June 2005: 75 % annuals (mostly *Schmidtia kalahariensis*) and 25 % bare areas.
Botanical composition – June 2006: 37 % perennials (*Stipagrostis uniplumis* seedlings) and 63 % annuals (*Schmidtia kalahariensis*).
Botanical composition – June 2008: 52 % perennials (*Stipagrostis uniplumis* 45 % and *S. ciliata* 7 %), and 48 % annuals (*Schmidtia kalahariensis*).
Success rate: 84 % of *Rhigozum trichotomum* bushes were dead, while 16 % were affected but still showed signs of life.


Site 2: June 2008, after treatment

Site 3:

Target spp.: *Rhigozum trichotomum.*
Bush density: 1 850 bushes/ha in the height class 1–2 m.
Treatment: 3 kg/ha Molopo GG P200 pellets/ha, or 300 g per 10 x 100 m strip.
Cost: N$ 204.00/ha.
Botanical composition before treatment – June 2005: 72 % annuals (mostly *Schmidtia kalahariensis*) and 28 % bare areas.
Botanical composition – June 2006: 34 % perennials (*Stipagrostis uniplumis* seedlings) and 66 % annuals (*Schmidtia kalahariensis*).
Botanical composition – June 2008: 67 % perennials (*Stipagrostis uniplumis* and *S. ciliata*), and 33 % annuals (*Schmidtia kalahariensis*).
Success rate: 96 % of *Rhigozum trichotomum* were dead, while 4 % were severely affected and would soon die.


Site 3: June 2008, after treatment

Site 4:

Target spp.: *Acacia nebrownii.*
Bush density: 1 600 bushes/ha in the height class 1,02 m.
Treatment: 2 kg/ha Molopo GG P200 pellets/ha or 200 g per 10 x 100 m strip.
Cost: N$ 134.00/ha.
Botanical composition before treatment – June 2005: 41 % perennials (mostly *Enneapogon desvauxii*), 39 % annuals (mostly *Schmidtia kalahariensis*), and 20 % bare areas.
Botanical composition – June 2006: 49 % perennials (*Stipagrostis obtusa*, *S. ciliata* and *S. uniplumis* seedlings) and 51 % annuals (*Schmidtia kalahariensis*).
Botanical composition – June 2008: 80 % perennials (*Stipagrostis obtusa*, *S. ciliata* and *S. uniplumis*), and 20 % annuals (*Schmidtia kalahariensis*).
Success rate: 89 % of *Acacia nebrownii* on the 2 kg/ha treatments were dead.


Site 4: June 2005, before treatment


Site 4: June 2008, after treatment

Site 5:

Target spp.: *Acacia nebrownii.*
Bush density: 2 650 bushes/ha in the height class 1–2 m.
Treatment: 2,5 kg/ha Molopo GG P200 pellets/ha or 250 g per 10 x 100 m strip.
Cost: N$ 167.30/ha.
Botanical composition before treatment – June 2005: 41 % perennials, 39 % annuals and 20 % bare areas.
Botanical composition – June 2006: 60 % perennials, 36 % annuals and 4 % bare areas.
Botanical composition – June 2008: 83 % perennials and 17 % annuals.
Success rate: 91 % of *Acacia nebrownii* on the 2,5 kg/ha treatments were dead.

Site 6:

Target spp.: *Acacia nebrownii.*
Bush density: 1 850 bushes/ha in the height class 1–2 m.
Treatment: 3 kg/ha Molopo GG P200 pellets/ha, or 300 g per 10 x 100 m strip.
Cost: N$ 204.00/ha.
Botanical composition before treatment – June 2005: 41 % perennials (mostly *Enneapogon desvauxii*), 39 % annuals (mostly *Schmidtia kalahariensis*), and 20 % bare areas.
Botanical composition – June 2006: 63 % perennials (*Stipagrostis obtusa*, *S. ciliata* and *S. uniplumis* seedlings), 29 % annuals (*Schmidtia kalahariensis*), and 8 % bare areas.
Botanical composition – June 2008: 75 % perennials (*Stipagrostis obtusa*, *S. ciliata* and *S. uniplumis*) and 25 % annuals (*Schmidtia kalahariensis*).
Success rate: 91 % of *Acacia nebrownii* on the 3 kg/ha treatments were dead.

Overall results

The grass production was measured by clipping 40 quadrates (1 m^2) in the treated area, and the same in the camp next to the treated area, which was untreated and served as a control. The costs of the three different application rates were also compared. Results are given in Tables 2 and 3 respectively.

Table 2. Comparison of dry material (DM) production, grazing capacity and income between treated and untreated sites

Site	DM production (kg/ha)	Grazing capacity (kg AB/ha)	Income/ha (N$)
Control	481	22	88.55
Treated	1 314	60	241.50


Site 5: June 2005, before treatment


Site 5: June 2008, after treatment


Site 6: June 2005, before treatment


Site 6: June 2008, after treatment

Table 3. Comparison of cost between three different Molopo GG P200 application rates

Treatment (kg Molopo GG /ha)	Cost of Molopo GG/kg (N$)	Cost of treatment (N$/ha)
2	67	134.00
2,5	67	167.30
3	67	204.00

3. SAVANA SC (Tebuthiuron 25 % and Bromacil 25 %) on *Acacia nebrownii*

Date of treatment: June 2004.
Target spp.: *Acacia nebrownii* as the dominant invader.
Bush density: Up to 4 600 bushes/ha.
Area treated: 1 ha consisting of calcareous soils and of other areas around pans, where clay percentages are usually somewhat higher than in surrounding areas.
Treatment: Savana SC 500 (Tebuthiuron 25 % and Bromacil 25 %) was mixed (5 L Savanna to 30 L of water). It was applied to the soil, close to the stems of the bushes, at a rate of 2 ml/0,5 m bush height. Application was done with a syringe.
Cost: 1 L active/ha @ N$ 150.00/L = N$ 150.00/ha.

Botanical composition before treatment – July 2004: 25 % perennials; 75 % annuals.
Botanical composition – June 2006: 50 % *Stipagrostis uniplumis* seedlings, 10 % *Enneapogon desvauxii and* 40 % *Schmidtia kalahariensis.*
Botanical composition – June 2008: 65 % *Stipagrostis uniplumis*, 8 % *Stipagrostis obtusa*, 7 % *Enneapogon desvauxii* and 20 % *Schmidtia kalahariensis.*

Results

The results of the bush mortalities were 100 % on the calcareous soils and 85 % around the pans. The bigger *A. nebrownii* bushes (3–4 metres) were more difficult to eradicate. No biomass measurements were done after this trial.


July 2004, before treatment


June 2008, after treatment

CONCLUSION

Both arboricides, Savana SC and Molopo GG 200 can be used to eradicate *Rhigozum trichotomum* and *Acacia nebrownii*. Aerial application is the cheapest method at 2,5–3,0 kg/ha where bush densities are less than 2 000 per hectare and bushes fall within the height class of 1–2 m. Plants smaller than 1 m at densities less than 2 000 plants per hectare can be treated manually with Molopo SC 500 (Tebuthiuron) or Savana SC (Tebuthiuron 25 % and Bromacil 25 %).

The clay content of soil significantly influences the effectiveness of invader bush eradication. The higher the clay content, the higher the dosage required and the higher the cost. A clay content of 25 % is the highest level at which these arboricides can successfully be applied. The effectiveness of arboricides diminishes dramatically on soils where the clay content exceeds 25 %. On calcareous soils the successful control of invader bush with Savanna SC and Molopo GG is virtually guaranteed.

With a grazing capacity improvement of 300 %; an improvement in botanical composition from mainly annuals and bare patches to perennial grass species; and an increase in income from N$ 88.55 up to N$ 241.50 per hectare; the use of arboricides to deal with bush encroachment in southern Namibia seems to be a viable option.

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