# Developing Sesame as a new heat and drought tolerant summer crop option in northern farming systems – Herbicide options.

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**Abstract**

Sesame is a new cropping option for modern farming systems in Australia, due to the advancement of non-shattering varieties by Equinom from Israel, which has been impeded by mechanised harvesting until now. Sesame faces agronomic challenges similar to most other crops like identifying the optimum planting time and density, varietal choice and pest and disease management. With the support of AgriFutures through their new and emerging industry program, Savannah Ag and our research partners are addressing the key agronomic challenges of growing elite sesame varieties. Through this research, we aim to deliver a grower best management package that supports the adoption of, and inclusion of sesame in to crop rotations for growers across northern Australia. These tactical agronomy solutions combined with the necessary permits and registrations to control key weed, insect and disease pests will support growers in achieving optimal yields and quality in their farming system. Herbicide screening trials are ongoing to identify potential chemicals that could provide permitted use for the control of broadleaf weeds post crop emergence

**Keywords**

Non-shattering, best management package, tactical agronomy, weeds

**Introduction**

Sesame (*Sesamum indicum*) is an ancient oilseed crop cultivated by humans for over 5000 years and is renowned for its heat and drought tolerance, and high oil yield and quality. In 2019, 6.55 million tonnes of sesame was grown globally, dominated by countries in Sub-Saharan Africa, India, China and Myanmar. Approximately 2 million tonne of sesame seed products are traded annually. This is valued at $3.5Billion.

Sesame, however, until recently has been hand-harvested due to the splitting (dehiscing) nature of the seed capsule when mechanically harvested. Equinom, an Israel based seed technology company has been able to breed and commercialise non-shattering, high yielding sesame varieties that are now forming the basis of a new and emerging industry for northern Australia. Australia currently imports nearly $60Million of sesame products annually. With this comes the need to develop farming practices to assist with the management and expansion of sesame in Australia, so growers can confidently adopt this crop into their systems.

In 2020, Agrifutures commenced the funding of several agronomic trials to evaluate key management practices such as time of sowing and planting density to optimise the yield of several varieties across a range of environments. This included the elite non-shattering varieties from Equinom, and the shattering black sesame lines from Agriventis. Also tested was a range of herbicides to assist with broadleaf weed control. In 2021, the herbicide research is now focusing on a select group of products that proved safe in initial screening trials, to now look at rate and timing of application to assess crop safety. Additional research is underway to survey key insect pests and diseases, so that an output from this year's research will be a comprehensive grower guide of pests, weeds and diseases of Sesame in

Australia, that will pave the way for permitted use of the required chemistry to advance sesame production.

In 2021, the sesame industry has also witnessed the development of a 5 year Strategic RD&E Plan, and the establishment of an Industry Reference Board, charged with the implementation of this plan. This is giving clarity to the priority areas important to the industry five-year goal of becoming a $10Million GVP industry.

**Methods**

*Evaluation of both pre-emergent and post-emergent broadleaf herbicides and their crop safety in sesame (Project 1)*
During 2020, the Queensland Department of Agriculture and Fisheries Weed Science team based at Toowoomba, conducted pot trials in a controlled environment, and tested a range of both pre-emergent and post-emergent broadleaf herbicides (Table 1) for their impact on sesame crop safety. A single herbicide rate (bottom end of label range) was chosen at a single application time to help screen herbicides and identify those considered safe for further evaluation.

**Table 1. Pre- and post-emergence herbicide treatments applied to sesame.**

| Pre-emergence treatments * | | |
|---|---|---|
| Product | Active ingredient | Product rate |
| Balance | Isoxaflutole | 100 g/ha |
| Boxer Gold | Prosulfocarb+ S-Metolachlor | 2.5 L/ha |
| Dual Gold | S-Metolachlor | 1 L/ha |
| Valor | Flumioxazin | 210 g/ha |
| Spinnaker | Imazethapyr | 70 g/ha |
| StompXtra | Pendimethalin | 1.5 L/ha |
| Diurex | Diuron | 1 kg/ha |
| Gesaprim | Atrazine | 1.1 kg/ha |
| Post-emergence treatments * | | |
| Broadstrike | Flumetsulam | 25 g/ha |
| Brodal | Diflufenican | 100 mL/ha |
| Blazer | Acifluorfen | 1 L/ha |
| Basagran | Bentazone | 1 L/ha |
| Diurex | Diuron | 0.5 kg/ha |
| Kamba500 | Dicamba | 280 mL/ha |
| Lontrel | Clopyralid | 75 mL/ha |
| Raptor | Imazamox | 50 g/ha |
| Associate | Metsulfuron Methyl | 5 g/ha |
| Buttress | 2,4D-B | 1 L/ha |
| Starane Advanced | Fluroxypyr | 300 mL/ha |
| Sencor 750 | Metribuzin | 500 mL/ha |

* Treatments were applied via a motorised spray cabinet using DG95015EVS nozzles at 2 bar pressure to delivery an output of 114 L/ha and surfactants were added in accordance with label recommendations.

*Evaluation of a select group of post-emergent broadleaf herbicides considered safe in sesame identified in project 1 (Project 2)*
During 2021, further experimentation was undertaken on four herbicides (Brodal Options, Broadstar, Kamba750 and Lontrel Advanced) identified safe from the previous research. Trials were undertaken

to now consider the impact of rate and timing of these herbicides on two commercial varieties of sesame under controlled growth cabinet conditions of 12hour/12hour cycle at 30° day / 20° at night.

**Results**

Below are the summarised results from the 2020 post-emergent herbicide screening trial. The pre-emergent trial results are not shown, as no safe products were identified. The research on post-emergent herbicides and impact of rate and timing on two commercial varieties of sesame will be completed in early 2022.

*At 21 DAT, there were clear differences in sesame growth as measured in plant height (Figure 1) and dry weight biomass (Figure 2). Sesame plant survival was only impacted by Blazer which killed all but 3 of the 30 plants treated.*

Plant height of sesame treated with Brodal, Basagran and Lontrel was not significantly different to untreated sesame (P<0.001) (Figure 1. Kamba, Diurex and Sencor reduced sesame plant height to 78-89% of the control while the remainder of the herbicides reduced height to 10-66% of the control.

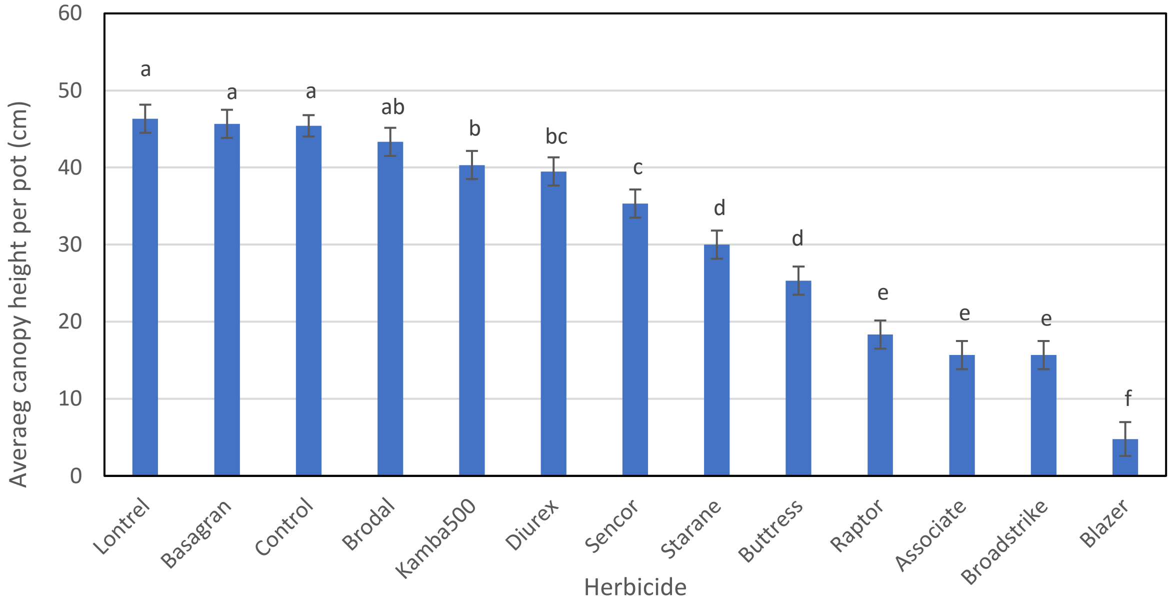


**Figure 1. Average plant height (cm/pot) of sesame treated with a range of post-emergence herbicides at the four pair leaf stage and assessed 21 DAT. Treatments with a different letter are significantly different at P=0.05. Bars represent standard error of the means of three replicates.**

Plant biomass as a measure of plant growth, was not significantly reduced by Basagran, Lontrel or Kamba when compared with the control treatment (P<0.001) (Figure 2). The biomass of Blazer was reduced to 2.5% of the control while for all other treatments biomass was reduced to 50-83% of the control plants.

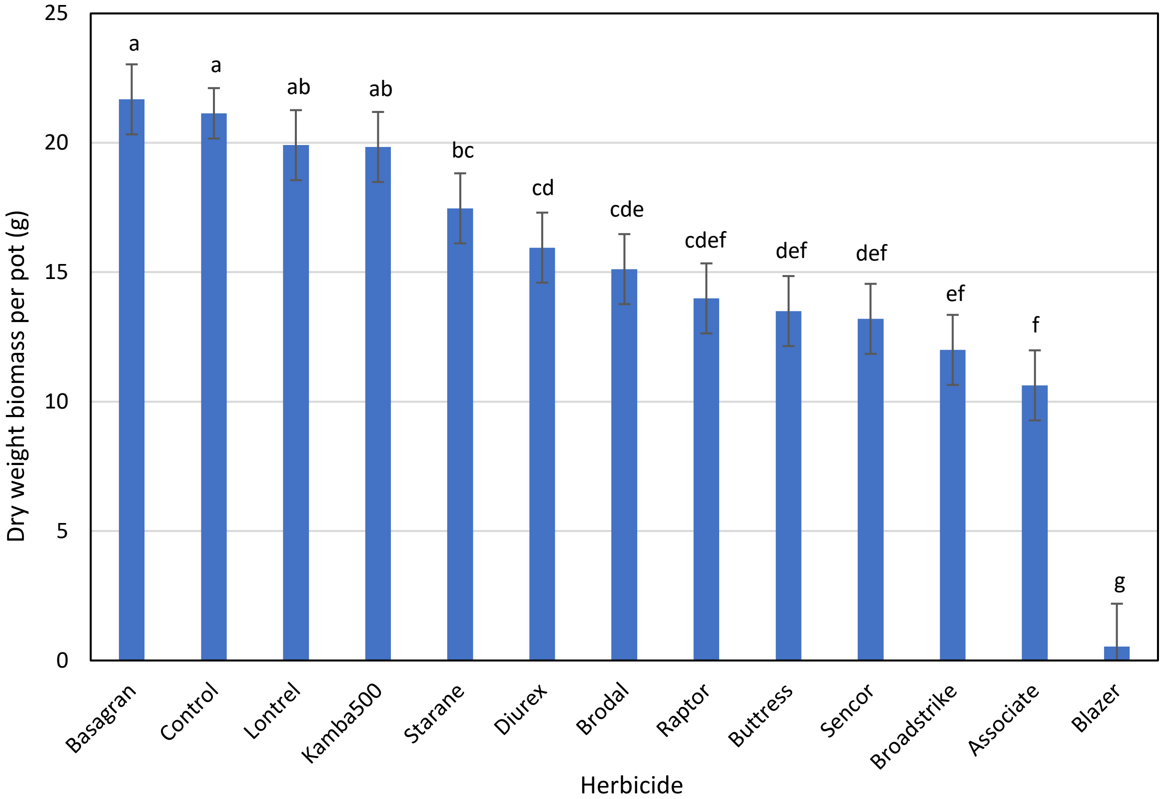


**Figure 2.1 Average plant dry weight biomass (g/pot) of sesame treated with a range of post-emergence herbicides at the four pair leaf stage and assessed 21 DAT. Treatments with a different letter are significantly different at P=0.05. Bars represent standard error of the means of three replicates.**

Basagran and Lontrel did not reduce plant height, biomass or survival of sesame plants and there was minimal visual impact of treatment with these two herbicides. Similarly, plant height for Brodal was not significantly reduce, although there was a significant reduction in plant biomass and some damage to leaves. Likewise, with Kamba, there was a significant reduction in height but not in biomass or survival. Sesame treated with Kamba had some leaf twisting and thicker plant base. All other herbicides reduced plant height, biomass and survival to levels that make them unsuitable for use in sesame.

## Conclusion

From the completed Project 1 herbicide study, Basagran, Lontrel, Brodal and Kamba are all herbicides likely to be suitable for use in sesame for weed control and form the basis of work in Herbicide screening, Project 2.

With the Sesame Industry Reference Board now established, they are focussed on prioritising and informing industry on research areas of focus to deliver industry outcomes. Some of these include more specific areas on supply chain factors such as safe and efficient storage, handling grading and processing, however, agronomic challenges remain a key priority. The ongoing 2021 pest research has a clear focus on delivering to growers a professional reference document that will highlight the key pests, weeds and diseases of sesame in Australia, explore some of the available risk management activities to reduce their impact, and inform industry and agencies on application permits required to give growers a toolbox of strategies to assist them in achieving productivity.

A goal has been set, to reconvene as an industry in 2025 and analyse the delivery of the current five-year strategic plan and review the research that has been undertaken for Australian sesame growers.

This will be titled the “Second Australian Sesame Workshop”, and will be held on the 30th Anniversary of the First.

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