SUPER HIGH OLEIC SAFFLOWER
A GAME CHANGER FOR GRAIN GROWERS

ROSEMARY RICHARDS (GO RESOURCES)

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

16/08/2016

SUPER HIGH OLEIC SAFFLOWER

- Super high oleic safflower has been developed by GRDC and CSIRO as an alternate high value rotation crop that produces 92% oleic acid in every litre of oil produced.
- It is the purity of the oleic acid and the corresponding very low levels of other fatty acids that provides significant functionality advantages compared to current bio-based oils i.e. palm, HO canola, HO soybean and HO sunflower
- Super high oleic safflower oil is being produced for a range of Australian and global industrial markets including as a base for lubricants, plastics, polymers, resins, cosmetics and biofuels.
- GO Resources an Australian company based in Melbourne has the rights to develop and commercialise Super High Oleic safflower.
- Following the granting of all required regulatory approvals super high oleic safflower was released in south-eastern Australia for commercial production in 2019.
- Super high oleic safflower is being grown by grain growers via a closed loop contract with a 2019 'farm gate' contract price is $650/mt.

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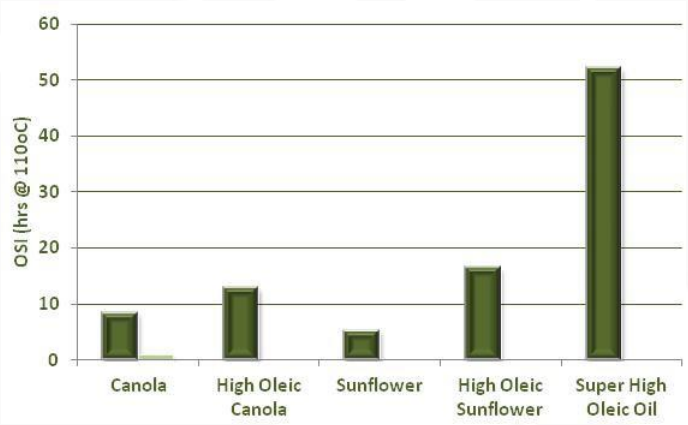
The Game Changer - Not all bio-based oils are equal!

Fatty Acid Content – Purity of Oleic Acid

Average Content:	Stearic acid (C18:0)	Oleic acid (C18:1)	Linoleic acid (C18:2)	Linolenic acid (C18:3)	Palmitic acid (C16:0)
Super High Oleic Safflower Oil	2 %	93 %	2 %	0%	3 %
HO sunflower	3-6%	75-90%	2-17%	Max 0.3%	3-5%
HO soybean	4%	75%	7%	2.5%	6.5%
HO Canola	2%	68%	20%	3%	4%
Palm	5%	39%	11%	0.2%	43%
'Normal' Safflower Oil	3%	17%	76%	0.2%	4%

Performance as measured by Thermal Stability



✓ **Compared to palm, HO sunflower, HO soybean & HO canola oils, GO Resources' super high oleic oil provides superior thermal properties and functionality which make it ideal for use in industrial applications**

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The Game Changer – New markets

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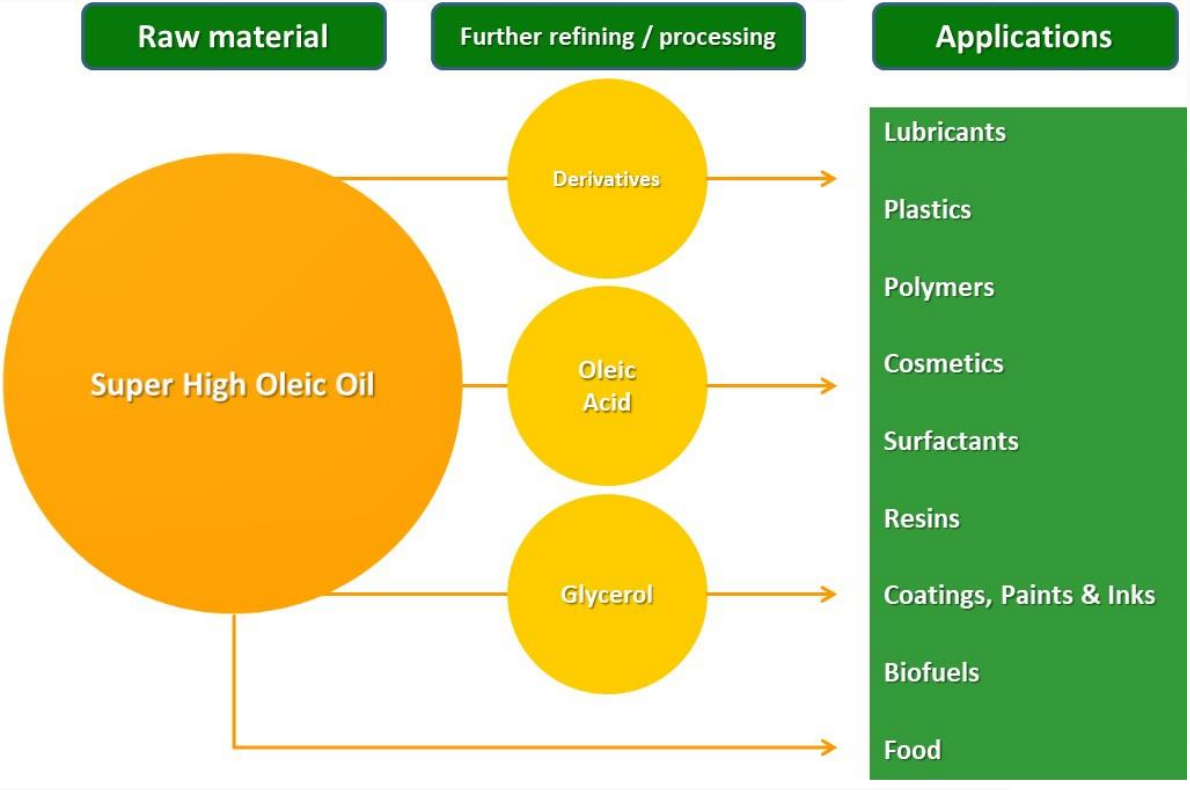

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The Game Changer – New bio-based engine oil

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- **Just completed preliminary development testing in May 2019!!**
  - **Testing at Montana State Uni – Advanced Fuels Center**
    - **Reduced friction over synthetic oils by 83%**
    - **Reduced friction over conventional oils by 124%**
    - **Reduces tailpipes emissions by 48%**
    - **Reduces engine wear**
    - **Increases fuel economy >10% (actual usage in cars)**
    - **Reduces Environmental contamination**
    - **100% recyclable**
  - **USDA Certified Biobased Product**
    - **Certified at 98% (ASTM 6866)**

Entering Formal Testing Program!

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The Game Changer – New bio-based engine oil

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D 4172 Test Method for Wear Preventive Characteristics (Four-Ball Method)

GO Resources' Super High Oleic Safflower Biobased Engine Oil

- **Note wear on bearings**
- **Note SHOSO pressure increased >2 fold to produce any scar**

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The Game Changer – Reduced Frictions leads to Reduced Tailpipe Emissions

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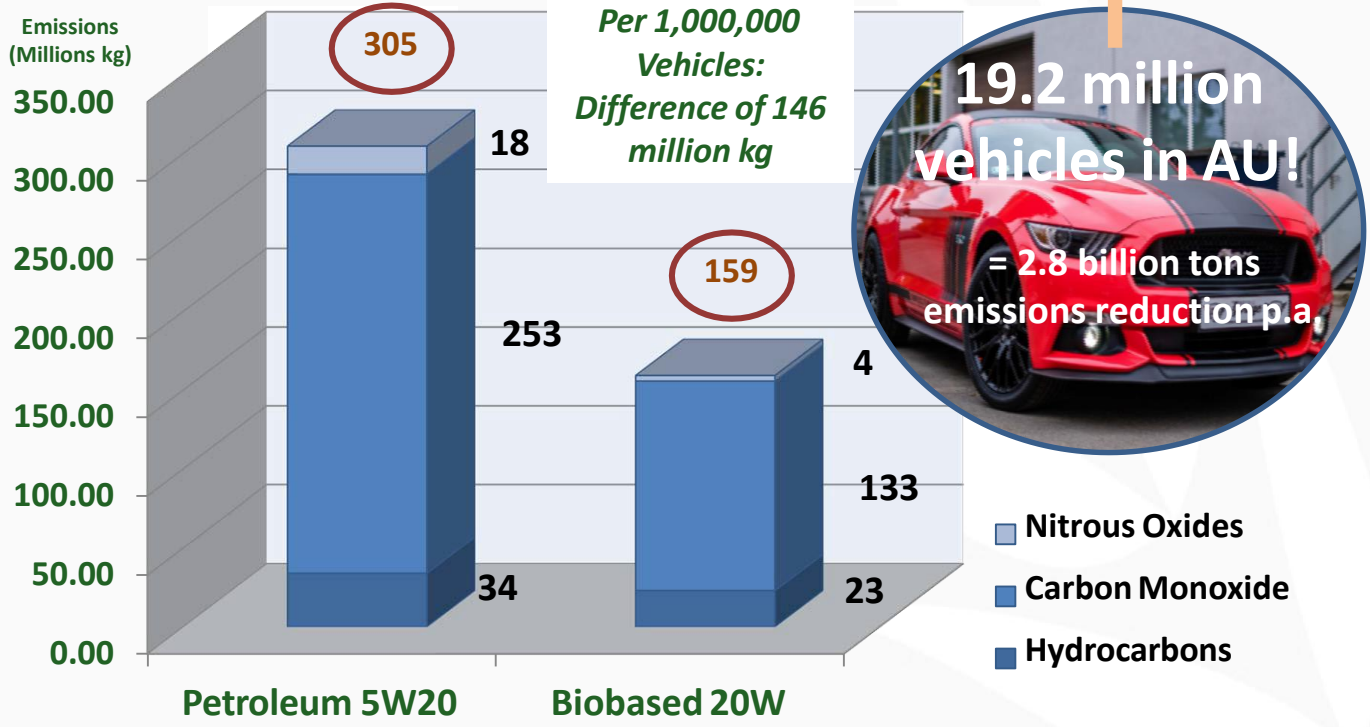

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The Game Changer – Growing Super High Oleic Safflower

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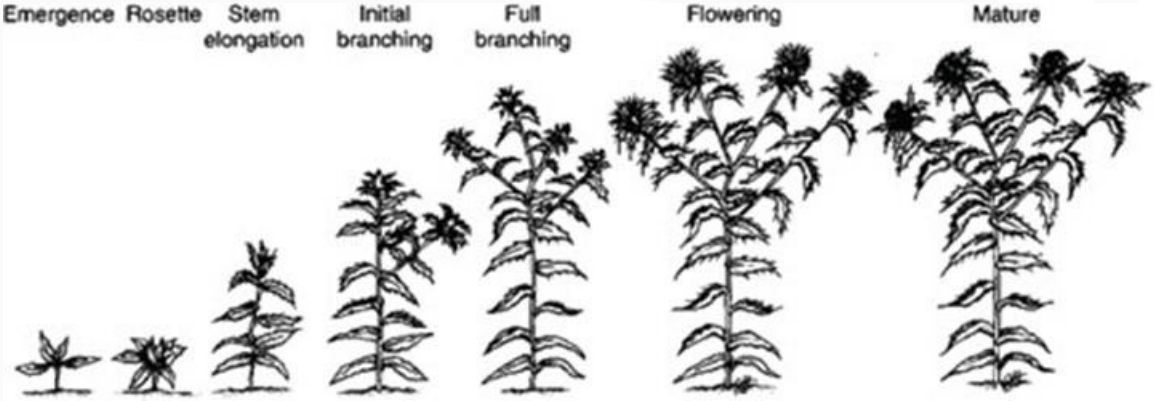
Safflower is a winter/spring growing crop that is:

- heat and drought tolerant,
- moderately tolerant of sodic and saline soils,
- suited to both dryland and irrigation farming systems,
- low input, low maintenance and easy to grow,
- machinery requirements similar to cereal /canola production.



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The Game Changer – Why grow safflower?

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Reasons for growing safflower in your crop rotation? (Victoria / Sth. NSW)	2010 Responses (%)		Reasons for growing safflower in your crop rotation? (Northern NSW)	2014 Responses (%)
Improves soil structure	24%		Opportunity crop when the sowing window for other winter crops has closed.	25%
Good weed control tool	19%		Spreads workload for both planting and harvest times.	15%
Water use/profile drainage	17%		Disease, weed or insect pest break in the rotation.	14%
Flexible time of sowing	19%		Attractive market prices.	14%
Low input/cheap to grow	12%		Low nutritional inputs needed to grow the crop.	11%
Easy to grow	12%		Breaks up a compacted profile or a hardpan.	10%
Disease break	10%		Dries out a saturated profile.	5%
Spread workloads	7%		Deters pests; pigs, kangaroos and emus.	5%
Non cereal/pulse option	2%		Other	0%

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The Game Changer – What do I need to know about growing safflower?

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The Game Changer – What do I need to know about growing safflower?

Sowing time	May to September	
Early Development	Safflower takes 1 to 2 weeks to germinate. Cold conditions (e.g. frosts) post sowing will delay emergence. After emergence, it stays 2 to 4 weeks in the rosette stage. On average, safflower is ready to harvest about 35 to 40 days after the peak of flowering.	
Flowering	End October /November – December - Each plant produces a number of branches generating multiple flower heads. Flower petals are red, white, yellow, or orange. Each head contains 20 to 100 seeds.	
Harvest	Matures in 110 – 170 days On average, safflower is ready to harvest about 35 to 40 days after the peak of flowering.	
Yield - dryland	1.0 – 1.5 t/ha	
Yield - irrigated	2.0 – 3.0 t/ha	

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The Game Changer – What do I need to know about growing safflower?

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Sowing rate	18 – 22 kg/ha (dryland) : 30 – 35 plants/m2 12 – 18 kg/ha (irrigation) : 20 – 25 plants/m2
Nutrition	*Nitrogen:* 30kg/ha of nitrogen (dryland crops) / 100kg/ha for high yielding crops under irrigation. No more than 20kg/ha at sowing. *Phosphorus:* 12 to 20kg/ha of phosphorus is recommended on deficient soils. Responses are unlikely on soils with Cowell P levels above 40mg/kg. *Potassium:* Most soils in the cereal growing regions of Australia contain adequate levels. *Sulphur:* Soil sulphur levels should be monitored with soil tests and sulphur can be applied as gypsum or as a component of a blended fertiliser when necessary. *Manganese, Iron and Zinc: S*afflower responds to manganese, iron and/or zinc. These are best applied as a foliar application around six weeks after sowing.
Disease	In periods of higher than normal rainfall, fungal diseases such as Phytophthora root rot, Alternaria leaf spot (Alternaria cartharmi), Pseudomonas bacterial blight (P. syringae), and Sclerotinia rot can cause serious losses. Consult local agronomist for control options.
Pests	Red Legged Earth Mites, Wireworms and cutworms can damage seedlings. Rutherglen Bug, Grasshoppers and Lygus bugs can damage the crop. Consult local agronomist for control options.

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The Game Changer – What do I need to know about growing safflower?

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Weed Control

Registered	APVMA Minor Use Permit in Safflower - Status	
	Granted in 2019	Applied For in 2019
Trifluralin	S-Metolachlor	Propyzamide
Avadex Extra	Clethodim	Pyroxasulfone
Diclofopmethyl		Prosulfocarb + S-Metolachlor
Propaquizafop		
Pendimethalin		
Metsulfuron methyl		

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The Game Changer – 2019 Research Program

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Field Trial Location	Time to Seeding x SHO Variety	Safflower Herbicide Tolerance Screen	Safflower Plant Nutrition	2nd Generation SHO Variety Evaluation	SHO Safflower Sodic Soil Tolerance
Kalkee					
Lower Norton					
Goroke					
Werneth					
Woorndoo (Spring)					
Rutherglen					
Lockhart					
Marrar					
Quandialla					
Bellata					
Goondiwindi					
Atherton Tablelands					
Kununurra					
Total	8	7	6	5	1

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The Game Changer – 2019 Time to Seeding (Kalkee, Vic)

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7th May TTS 1)

17th May (TTS 2)

30th May (TTS 3)

Photo: 6th July

11th June (TTS 4)

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The Game Changer – 2019 Time to Seeding (Goondiwindi)

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15th May (TTS 1)

30th May (TTS 2)

12th June (TTS 3)

26th June (TTS 4)

Photo: 17th July

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The Game Changer – 2019: 2nd & 3rd Generation SHO variety evaluation

Focused on 4 value adding targets:

1. Increase grain yield reliability and oil content through the development of regionally adapted SHO safflower varieties.
    a. Innovative use of diverse germplasm (accelerated breeding)
    b. Increasing early vigour
    c. Development of hybrid SHO safflower varieties
    d. Faming system optimisation
2. Increase the Harvest Index (HI) and Water Use Efficiency (WUE)
3. Increase the level of resistance to Alternaria (*Alternaria carthamii*), which may become more prevalent if safflower production increases due to additional sources of inoculum
4. Add value to seed meal and trash

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The Game Changer – 2019: 2nd Generation SHO variety evaluation

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Accelerated SHO safflower breeding program ($2m / 3 years) @ Agriculture Victoria

Accessing diversity 300+ safflower lines

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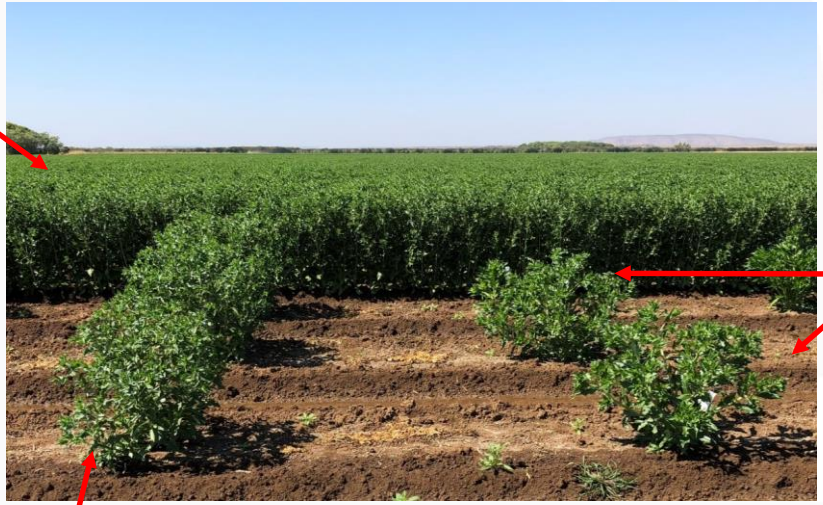
The Game Changer – 2019 2nd Generation SHO Variety

STAGE ONE
2019 SHO Safflower Variety Release (E 40-R)



STAGE THREE
AgriBio Accelerated parental breeding program for 2023+ release

STAGE TWO
2021 Variety Release – Montola 2003 + 4% - 5% Oil Content

STAGE FOUR
HYBRID SHO Safflower 2024+

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The Game Changer – 2019 2nd Generation SHO Variety (Goondiwindi)

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Planted 15th May / Photo: 17th July

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Thank You

Grains Research and Development Corporation (GRDC)

A Level 4, East Building, 4 National Circuit, Barton, ACT 2600 Australia

P PO Box 5367 Kingston, ACT 2604 Australia

T +61 2 6166 4500

F +61 2 6166 4599

www.grdc.com.au

@thegrdc