



An evaluation of safflower germplasm in the Australian Temperate Field Crops Collection

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Abstract

An evaluation of 10 diverse safflower (*Carthamus tinctorius*) accessions from across the world held in the Australian Temperate Field Crops Collection showed considerable variation in phenology, agronomic traits and plant architecture. Time to flowering ranged from 73 to 88 days after sowing, plant height post flowering from 45 to 100 cm and branching angle from appressed to spreading. The accessions also differed in degree of leaf spininess and susceptibility to leaf rust. Knowledge of the diversity present in existing germplasm collections and the availability of viable seed stocks can assist breeding programs, especially given that safflower seed imported into Australia must first be regenerated in quarantine which takes time and money.

Introduction

The Australian Temperate Field Crops Collection (ATFCC) conserves, evaluates, and regenerates genetic diversity of pulse and oilseed crops. This is made available to crop breeders and researchers in Australia and globally. Over 34,000 pulse and oilseed accessions are currently conserved in the collection, including 530 landraces (traditional farmer varieties), breeding line and cultivar accessions of safflower (*Carthamus tinctorius*). A generation in quarantine is required to ensure that safflower seed entering Australia is disease free.

Ten accessions (Table 1), which provided a geographic cross section of the world diversity of safflower germplasm held in the ATFCC, were sown for seed increase and evaluation in 2007.

Materials and Methods

Plots were machine sown in 3 × 2 m plots at Horsham, Victoria, on 8th October 2007. The seeding rate was 10 kg/ha. Prior to flowering, isolation tents were erected on each plot to prevent cross pollination. Plots received supplementary irrigation as required.

The traits recorded were: duration from sowing to flowering and to maturity, plant height post flowering (91 days after sowing), branch location on the main axis, angle of branches, degree of leaf spininess and dry corolla colour, using safflower descriptors (IBPGR 1983). Susceptibility to a natural infection of rust (*Puccinia carthami*) was also recorded.

Results

A considerable range of variation was observed in the 10 accessions evaluated (Table 1). The duration between sowing and 50% flowering ranged from 73 to 88 days, whilst the duration between sowing and 75% of plants in each plot reaching physiological maturity (flower bracts faded brown) ranged from 119 to 140 days. Plant height post flowering ranged from 45 to 100 cm, leaf spininess from non spiny to many spines, branch angle from appressed (15 – 20°) to spreading (60 – 90°), bracts either incompletely or completely enclosing heads and dry flower colour from yellow, orange through to red (Table 1).

The position of branches on the main axis was mainly on the upper two thirds for most accessions, but relatively even for accession 120274. Accessions 120060, 120102, 120201 and 120274 were susceptible to a natural infection of rust, with mature pustules present on leaves around the time of flowering.



Table 1.

Some characteristics of 10 diverse safflower accessions held in the Australian Temperate Field Crops Collection.

Accession	Origin	Flowering ^a	Maturity ^b	Hgt ^c	BL ^d	BA ^e	Spn ^f	Brc ^g	Corolla ^h
120060	India	77	119	60	3	5	5	1	Orange
120095	USA	88	133	85	3	5	3	1	Yellow
120101	Iran	80	119	65	3	5	0	1	Yellow
120102	Turkey	82	129	65	3	3	1	1	Red
120107	Sudan	77	127	70	3	5	0	2	Red
120122	Afghanistan	73	127	55	3	5	5	1	Orange
120201	France	77	119	45	3	7	7	1	Orange
120228	Japan	88	140	70	3	5	5	2	Red
120274	China	88	127	100	4	5	5	1	Orange
120281	Pakistan	73	119	60	3	3	5	1	Orange

^aDays from sowing to 50% of plants with first flower, ^bDays from sowing to 75% of plants at physiological maturity, ^cPost flowering (cm), ^dBranch Location on main axis (3=mainly upper 2/3, 4=uniform), ^eBranch Angle (3=appressed 15-20°, 5=intermediate 20-60°, 7=spreading 60-90°),

^fLeaf spines (0=none, 3=few, 5=intermediate, 7=many), ^gBracts enclosing head (1=incomplete, 2=complete), ^hDry corolla colour.

Discussion

From an agronomic viewpoint, Australia would benefit from the availability of a wider range of safflower cultivars and the enhancement of certain plant characteristics. The most widely grown cultivar in Australia is *Sironaria*, which struggles to achieve a harvest index (HI) above 0.2 (Wachsmann et al. 2003). Improving HI to 0.3 which is typical for soil oilseeds like canola (*Brassica napus*), may increase water use efficiency and yields in drier situations, possibly through breeding to reduce stem height. Growers prefer capitula near the top of plants so that amount of stem entering harvest machinery is minimised and the purity of harvested seed maximised. Harvestability is also influenced by branch location on the main axis and branching angles. The degree that bracts enclose capitula can influence bird damage, seed loss through shattering and protection of seed from rain. Finally, spineless cultivars may appeal more to people having physical contact with safflower crops.

This limited sampling of the 530 safflower accessions currently held by the ATFCC indicates that a wide diversity of phenological, morphological and disease resistance traits exist within the collection that could be useful to breeding programs in the future.

Evaluation of seed oil contents and fatty acid profiles of the above 10 accessions is presented in the paper by Mailer et al (2008 –this conference).

Screening for resistance to leaf blight (*Alternaria carthami*), a serious disease of safflower in Australia, should also be considered.

References

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