

Fava bean variety trial for field and rooftop gardens in southern Ontario

IN A NUTSHELL

The growers' objectives were to document the best fava varieties for urban rooftop and field production across different farms in southern Ontario. From their replicated multi-farm trial they found:

- Distinguishing the "best" and "worst" among fava varieties wasn't possible due to crop failure and missing data
- All fava varieties had issues with disease and heat stress, leading growers to note a need for regionally adapted varieties of fava
- Fava was a popular item at markets and through CSAs as many customers don't see fresh fava very often!

MOTIVATION

Fava beans, which are also known as broad beans or faba beans in English, habas in Spanish, fūl in Arabic, and baqella in Amharic are an important staple in diets throughout the world. The center of domestication for fava beans is the Middle East, with secondary areas of domestication recognized in southern and northern Europe, Ethiopia, and southern China (1). Fava beans are highly nutritious because of their high protein content and high levels of mineral nutrients, vitamins, and numerous bioactive compounds. Equally important is the contribution of fava beans in symbiotic fixation of atmospheric nitrogen (2).

Fava beans are a cool season plant that are grown as a winter annual in warm temperate and subtropical areas, and as a cool season crop in colder areas like Ontario. Optimum soil temperatures for germination are between 15 and 18 °C. Germination will not occur at temperatures below 4 °C or above 24 °C, but there are differences between cultivars (3). The optimum temperatures for growth range from 18-29 °C, while temperatures above 32 °C will restrict growth and yields (3). Fava can also be sensitive to drought conditions, with the most drought-sensitive growth stages being flowering, early podding, and grain filling (2). Fungal diseases, such as ascochyta blight, chocolate spot, and rust can severely damage fava beans especially in wet weather, while aphids are a common insect pest (2).

Micheline Lalond, the gardener at Avling Rooftop Farm in Toronto, was interested in finding the best variety to grow in their rooftop gardens. This is a challenge because rooftops in the city often become hot, which can restrict growth and yield of favas.

This trial included two urban rooftop farms and two rural farms, with the general goal of identifying the most productive varieties of fava beans across different farms in southern Ontario during the 2022 season.

METHODS

In 2022 growers compared seven varieties of fava bean (**Table 1**) in a randomized and replicated trial. Each grower grew at least the three common varieties (Windsor, Vroma, Witkiem-Monica), but could choose to grow other varieties specific to their farm. Farmers, along with EFAO staff, chose common varieties of fava from seed companies that they usually source seeds from, but we also reached out to Canadian fava bean breeders to see what they'd suggest we include in these on-farm trials. Thus we included two breeding lines from plant breeder Jessa Hughes from the University of Saskatchewan and Vicia Genetics, as well as one selection from Guelph-based plant breeder Eric Landry of Backyard Seed Savers.

Farmer-researchers planted and grew the plants in the variety trial as they would normally grow fava beans, including bed and row spacing. Each farmer received approximately 25 - 30 seeds of each variety. They sowed all 30 seeds of each variety with the goal of at least 20 seedlings so that they could have at least 10 plants of the variety in each of the two replications.

Crop management records for seeding dates, transplant dates, and varieties grown can be found in **Table 2**. Growers used either drip or overhead sprinkler irrigation and organic fertilizers as required.



FARMER-RESEARCHERS

Micheline Lalond, Avling Rooftop Farm
Michelle Dang, Toronto Metropolitan University Urban Farm
Martina Schaefer, Spiral Farm
Leslie Moskovits, Cedar Down Farm

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Table 1. Complete list of fava varieties that the growers selected to trial in 2022

CODE	VARIETY	DTM	SOURCE	INTELLECTUAL RESTRICTIONS ¹	GROWN BY ³
FBV1	Tendergreen	n/a	Backyard seed saver (Erik Landry)	No (request from Erik Landry to talk to him if you'd like to grow this variety for seed)	ML, LM, MS, MD
FBV2	Windsor	75-85	Gaia Organics	No	ML, LM, MS, MD
FBV3	Witkiem-Monica	70	William Dam	No	ML, LM, MS, MD
FBV4	Vroma	75	Johnny's Seeds	No	ML, LM, MS, MD
FBV5	Aprovecho	n/a	BC Eco Seed Co-op	No	MD
FBV6	GR 2	n/a	Vicia Genetics (Jessa Hughes)	MTA ²	LM, MS, MD
FBV7	GR 4	n/a	Vicia Genetics (Jessa Hughes)	MTA ²	LM, MS

¹ A Plant Variety Protection (PVP) is granted by the United States Department of Agriculture. It protects a unique seed by prohibiting unauthorized commercialization. The PVP remains in effect for 20 years. Many PVP varieties are granted Plant Breeders Rights (PBR) in Canada.
² Material Transfer Agreement
³ ML- Micheline Lalond; LM- Leslie Moskovits; MS- Martina Schaefer; and MD- Michelle Dang

DATA ANALYSIS

To evaluate the effect of fava bean variety on germination, early season vigour, yield, and flavour, we used an analysis of variance (ANOVA) to calculate a p-value based on the difference we observed among treatments. We used a cut-off value of 0.05, meaning we wanted to have 95% confidence in any difference we observed. If the p-value was less than the cut-off value, we had confidence to say the treatment produced differences. If the p-value was more than the cut-off value, we concluded there was no statistical difference. If we detected a difference among treatments, we conducted another ("post-hoc") test to determine where the differences occurred between treatments.

We could make these statistical calculations because this trial's experimental design involved replication of the treatments both on-farm and across several farms.

FINDINGS

GERMINATION

Seed source can affect the germination rate and performance of a variety, such that the results presented here are based on the specific varieties and seed sources trialed.

Growers recorded germination rates for each of the varieties they chose to grow. They found a significant difference in germination among varieties ($P=0.001$). Using a least significant difference (LSD) of 14.5% seen in **Figure 1**, growers found that Tendergreen had a much lower germination rate than the rest of the varieties.

EARLY SEASON VIGOUR

Around a month after planting, growers evaluated early season vigour for each variety. For each replicate they ranked seedling vigour, including seedling size, health, and growth rate on a scale from very poor (1) to very high (5). Growers found a significant difference ($P=0.001$) in early season vigour of fava among varieties in the trial (**Table 3**). Using an LSD of 1.2 they found that Tendergreen and Windsor had a much lower early season vigour rating than the other varieties.

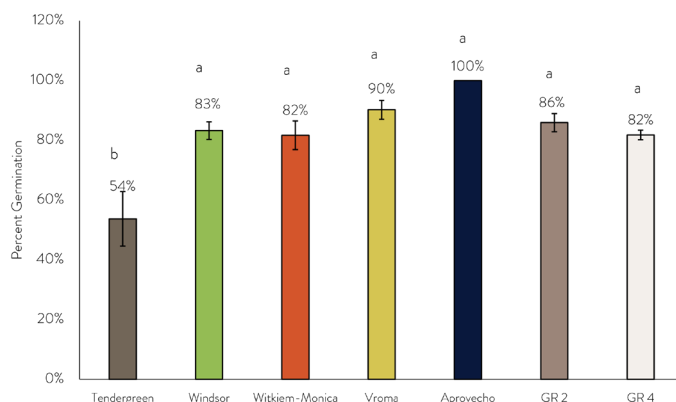


Figure 1. Mean germination rate for each variety of fava bean across farms.
**Lower case letters denote significant differences between varieties, based on a Tukey post-hoc multiple comparisons test.*

PLANT HEALTH OBSERVATIONS

Growers made observations on plant health, and how susceptible plants were to pressure from non-beneficial insects and microbes (**Table 4**). They noted that the largest pest issue appeared to come from aphids. They also noted that they saw disease pressure from fusarium wilt, mosaic virus, and one grower lost the entire crop to chocolate spot/ botrytis.

YIELD

Due to plant health issues, Martina was unable to collect yield data, and Leslie's data was misplaced. From July 13 to August 3, Michelle collected yield data for each of the replicate varieties during the harvest window. Micheline only harvested once/summed all harvest data. Growers graded the harvested fava beans into marketable and non-marketable pods and they counted and weighed each respectively.

Due to crop failure and missing data we were unable to perform a statistical analysis on the marketable and non-marketable yield. **Table 5** shows the mean total marketable and non-marketable pod count and weight for each variety across farms.

Table 2. Crop management record and data collected for each farm.

FARMER	SEEDING DATE	GARDEN TYPE	DATA COLLECTED
Micheline Lalond	May 11, 2022	Rooftop	All
Michelle Dang	May 19, 2022	Rooftop	All
Martina Schaefer	May 23, 2022	Field	Germination, early season vigour, and pest & disease
Leslie Moskovits	May 12, 2022	Field	Germination, early season vigour, pest & disease, and flavour



Favas in the field at Cedar Down Farm



Pods and beans from the six varieties grown at Cedar Down Farm

Table 3. Mean early season vigour rating for each variety across farms.

VARIETY	EARLY SEASON VIGOUR RATING*
Tendergreen	2.3 c
Windsor	3.3 bc
Witkiem-Monica	3.9 ab
Vroma	4.8 a
Aprovecho	4.0 abc
GR 2	4.5 ab
GR4	4.0 ab
LSD	1.2

* Lower case letters denote significant differences between varieties, based on a Tukey post-hoc multiple comparisons test.

Table 4. Plant health observations on varieties across farms.

VARIETY	PESTS	DISEASES
Tendergreen	aphids	mosaic virus, chocolate spot/botrytis
Windsor	aphids	fusarium wilt, Mosaic virus, chocolate spot/botrytis
Witkiem-Monica	aphids	fusarium wilt, Mosaic virus, chocolate spot/botrytis
Vroma	aphids, blister beetles	fusarium wilt, mosaic virus, chocolate spot/botrytis
Aprovecho	aphids	mosaic virus
GR 2	aphids	mosaic virus, chocolate spot/botrytis
GR 4	aphids	chocolate spot/botrytis



Favas in the rooftop garden at Avling in June



Michelle Dang harvesting favas at TMU

Table 5. Mean total marketable and non-marketable pod count and weight for each variety collected over the growing season from rooftop farms only.

VARIETY	MARKETABLE POD COUNT	MARKETABLE POD WEIGHT (g)	NON-MARKETABLE POD COUNT	NON-MARKETABLE POD WEIGHT (g)
Tendergreen	24	166	28	105
Windsor	25	220	28	159
Witkiem-Monica	30	540	17	162
Vroma	26	430	20	193
Aprovecho	2	18	19	80
GR 2	102	565	46	200
GR 4	-	-	-	-

**Due to a lack of data statistical analysis could not be undertaken for this information*

Table 6. Mean flavour rating and overall rating for each variety across farms.

VARIETY	FLAVOUR RATING	OVERALL RATING
Tendergreen	4.75 a	3
Windsor	3.33 a	2
Witkiem-Monica	3.33 a	3
Vroma	3.50 a	2.3
Aprovecho	3.33 a	0
GR 2	4.50 a	5
GR 4	-	-
LSD	1.25	NA*

**Due to a lack of data, statistical analysis could not be undertaken for this information*

FLAVOUR AND OVERALL

During the trial, growers rated each variety for flavour and overall rating. For flavour, the growers prepared the beans when all varieties were at peak harvest in this manner:

1. Shucked the beans from the shell
2. Boiled the beans for 1-2 minutes
3. Removed the beans from the boiling water and shocked them by adding them to a bowl of ice water
4. Removed the skins that surround the bean
5. Tasted the bean

The growers ranked the varieties for general taste and bitterness on a scale as follows: poor taste and bitter (1), okay (3), and excellent taste and sweet (5). Overall ratings were also taken, on a scale for overall performance as follows: poor (1), okay (3), and excellent (5).

Overall, growers did find a significant difference in flavour among varieties ($P=0.03$). However, they were unable to detect a difference between specific varieties using the second “post-hoc” test and an LSD of 1.25 (**Table 6**). These different results indicate the data was too variable to be confident in any true differences. Due to crop failure and missing data we were unable to perform a statistical analysis on the overall crop rating.

Growers’ notes on flavour and overall ranking of each variety in the trial can be seen in **Table 7**. Growers’ answers to “Would you grow this variety of fava again?” can be found in **Table 8**.



Diseased fava plants at TMU rooftop garden.

Table 7. Growers notes on flavour and overall ranking of each variety in the trial

VARIETY	MICHELINE	MICHELLE	MARTINA	LESLIE
TENDERGREEN	-	While this cultivar tasted great, plants did not have the best germination rate and many plants came up stunted	[No marketable pods]	-
WINDSOR	Fava was sweet, buttery texture, no bitterness, small bean. Fava did not produce well, suffered from pests and disease, small fruit production. Flavour was adequate but not the desired flavour for culinary purposes.	Although great taste, not the most high yielding because pods kept coming out with issues making them non-marketable	[No marketable pods]	-
WITKIEM-MONICA	Fava had a mild sweetness, slightly bitter, nice bean size. This was chef favourite, they preferred a slight bitterness vs only sweetness in FBV2. They found the flavour more versatile for cooking. Also, the slight bitterness was preferred because the flavour would be upheld in a recipe with other ingredients. Fava produced moderately well, was affected by disease and pest but had an acceptable harvest. Would grow again only for the flavour of beans.	Although high yielding, beans were big and so had a chalkier texture and not as nice taste	Seemed to be a bit less severely affected compared to other varieties, but still too damaged to produce a yield [No marketable pods]	Nice big beans, meaty, good texture
VROMA	Bean was a bit too bitter and did not have the balance of flavours of Witkiem-Monic. Fava suffered from pest and disease pressure, very little fruit. High yield of fruit but did not have the desired flavour.	All around decent in every aspect, just OK	[No marketable pods]	-
APROVECHO	-	prone to pests which as a result caused a low yield	-	-
GR 2	-	Great flavour and texture, good germination, plants came up great, and semi hardy to pests/diseases	[No marketable pods]	-
GR 4	-	-	[No marketable pods]	-

Table 8. Growers were asked “Would you grow this variety of fava again?”

VARIETY	MICHELINE	MICHELLE	MARTINA	LESLIE
TENDERGREEN	-	No	Trial Again	No
WINDSOR	No	No	Trial Again	Yes
WITKIEM- MONICA	Yes	No	Trial Again	Yes
VROMA	No	No	Trial Again	No
APROVECHO	-	No	-	-
GR 2	-	Yes	Trial Again	No
GR 4	-	-	Trial Again	Yes



Diseased fava bean plants at Spiral Veg Farm



Diseased fava bean pod at Spiral Veg Farm

CONTEXT AND CAVEATS

“A piece of advice we received from some community members about fava beans is that they can be consumed raw and/or cooked with the bean skin left on. A couple of us tried this out and they tasted great. We found the meatier, more bitter varieties were great for dishes where the favas were more processed (e.g., falafel). We liked the smaller, sweeter, more tender varieties in dishes where the beans were kept whole (e.g., eaten raw as snack food, riz b foul).” Michelle

NEXT STEPS

Although the trial wasn’t an overwhelming success, growers are interested in continuing with another iteration of the same fava variety trial with an earlier spring starting date, with the hope of less heat and disease stress for the plants. There is also interest in seeing how a fall planted fava performs.

Growers are also hoping to work with regional seed producers to breed a fava bean cultivar that is pest-hardy, disease-hardy, and better adapted to the climate in southern Ontario or looking at starting a landrace for the region.

TAKE HOME MESSAGE

All of the growers found the experience of growing favas to be a rewarding one although it was hard for growers to distinguish between the “best” and “worst” fava varieties for production in southern Ontario.

Growers found that fava beans were highly stressed throughout the season by pests, disease, and heat, causing growth issues. Given that fava beans are historically adapted to grow in eastern hemisphere climates, the stress could be due to these cultivars not being adapted to our regional climate.

“The best aspect of growing fava beans was being able to provide a source of fresh fava beans to individuals coming from cultures where fava beans are a culturally significant crop. In North America, fava beans are often only available canned or dried, so the joy and excitement people had over having access to fresh fava beans was priceless,” said Michelle.

REFERENCES

1. Smither-Kopperl, M. 2019. Plant Guide for fava bean (*Vicia faba*). USDA-Natural Resources Conservation Service, Lockeford Plant Materials Center. Lockeford, CA 95237. https://mccc.msu.edu/wp-content/uploads/2020/07/NRCS_2020_Fava-Bean-Vicia-faba-Plant-Guide.pdf
2. Karkanis A, Ntatsi G, Lepse L, Fernández JA, Vågen IM, Rewald B, Alsin, a I, Kronberga A, Balliu A, Olle M, Bodner G, Dubova L, Rosa E and Savvas D (2018) Faba Bean Cultivation – Revealing Novel Managing Practices for More Sustainable and Competitive European Cropping Systems. *Front. Plant Sci.* 9:1115. doi: 10.3389/fpls.2018.01115 <https://www.frontiersin.org/articles/10.3389/fpls.2018.01115/full>
3. Landry, E.J., C.J. Coyne, and J.Hu. 2015. Agronomic performance of spring-sown faba bean in Southeastern Washington. *Agronomy J.* 107: 574-578. https://www.researchgate.net/publication/272411419_Agronomic_Performance_of_Spring-Sown_Faba_Bean_in_Southeastern_Washington
4. Etemadi, F., Hashemi, M., Mangan, F., & Weis, S. (2015). Fava Beans; Growers guide in New England. Posted on Dairy, and livestock website: https://ag.umass.edu/sites/ag.umass.edu/files/research-reports/fava_bean_guide_2.pdf

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