

LAVENDER CULTIVAR TRIAL

MATERIALS AND METHODS

Trials were established at six sites across southern Ontario in 2010. Each grower host of a cultivar trial chose their own weed barrier (Table 1). Soil types were obtained from each site based on county soil maps (Table 1). The trials consisted of 27 lavender cultivars including 16 *Lavandula angustifolia* cultivars and 11 *Lavandula x intermedia* (lavandin) cultivars in 2013. Twenty-one of these cultivars were imported from Lavender at Stonegate (West Linn, Oregon, USA), and were clonally propagated as cuttings. One cultivar that was identified as “Twickle Purple”, which should be an *angustifolia* cultivar, was identified to be a lavandin. It is unknown where the mix-up in the cultivar occurred. This cultivar is identified as “unknown” throughout the report. One cultivar, Provence Blue, was only commercially available as seeds and was seeded at the Simcoe Research Station into 200-cell plastic plug trays into a 50% peat/50% perlite blend. Seed was purchased from Richter’s Herbs (Goodwood, ON). Since this cultivar was seed propagated, the plants were genetically variable. All of the cultivars were established in late June or early July, 2010. In 2011, five additional cultivars were added to the trials. Two of these cultivars were obtained from Richter’s Herbs, and three were obtained from an unknown supplier in Sequim, WA. In 2012, the cultivar ‘Alba’ was replaced with ‘Maillette’. Table 2 lists the cultivars along with their type and origin. Based on grower input and the need for industry standards, the top seven cultivars were replicated four times and were intended for full essential oil evaluation. These seven cultivars were Melissa, Provence Blue, Royal Purple, Royal Velvet, True Hidcote, Hidcote Giant and Grosso. The additional 20 cultivars were not replicated at each site. The replicated cultivars were planted into a randomized complete block design with four replications. The trials were designed for 10 plants in each experimental unit resulting in 40 plants of each of the replicated cultivars and 10 plants of each of the unreplicated cultivars.

Preplant soil analysis was performed on the sites in spring 2011 and results are listed in Table 3. Between- and in-row spacing for each site are listed in Table 4. Plants in all plots were initially watered immediately after transplanting with 300 ml of a solution prepared by dissolving 500 g of Plant-Prod 10-52-10 water soluble fertilizer in 200L of water. Additional watering was done by each grower as required. In May 2012 and early August 2013, supplemental fertilizer was applied at each site. Phosphorus and potassium were applied based on the soil tests and 50 kg/ha nitrogen was applied at each site in row middles. Weed control and flower removal were performed as required by each grower. Each fall, plants were assessed for size and shape in late September or October. This could not be done in 2014 due to severe winter kill and no way to accurately measure the plants. The assessment consisted of measurements of the height and width of each plant, and a rating of overall plant shape on a scale from 1 to 5 based on the percentage of a perfect dome the plant filled (1 = 1-20% filled, 2 = 21-40% filled, 3 = 41-60% filled, 4 = 61-80% filled, and 5 = 81-100% filled). Overall plant volume, the amount of air space filled by the plant, was estimated using the following equation where H=height in cm, W=width in cm, and S=shape rating:

$$\text{Volume} = (2/3\pi[(W/2)+H]/2)^3 \times (S/5)$$

For each year, winter kill analysis took place during the month of May and beginning of June (presented in Table 5). Each plant in the trial was rated on a scale of 0 to 10 based on the percentage of the trimmed plant showing no signs of winter-kill with 0 = apparently dead (plants may have sprouted from the base after the assessment), 1 = 1-10% of plant healthy, 2 = 11-20% of plant healthy....to 10 = 91-100% of plant healthy. Weather conditions throughout the trial for the closest Environment Canada weather station to each site are listed in Table 6. HOBO Micro Station (Onset Corporation) data loggers were placed at 4 of the 6 sites (Farms A, B, E and F) and air temperature at 30 cm height, soil temperature and 5 and 15 cm depth and soil moisture were tracked starting in December 2012. The soil moisture sensor measures volumetric water content. The values should be compared to field capacity for each site to determine how close to saturation the sites were for each month, and cannot be directly compared among sites. Readings drop to zero when the soil freezes, and soil moisture cannot be accurately assessed for those months. A HOBO Pro V2 data logger (Onset Corporation) was placed at Farm D and tracked air temperature at 30 cm height and soil temperature at 5 cm depth. Farm C had similar conditions as Farm B and weather conditions at that site were not recorded. The data logger at Farm E failed in August 2013, and battery or sensor failure occurred at additional farms. Available data is presented in Appendix A.

During the bloom period from June to August 2011 the percentage of buds open or past bloom was tracked for farms B, C, D, and E by assessing 20 flowers from each experimental unit. The same assessment was conducted weekly on all farms in June and July 2012 and 2013. In 2014, severe winter kill resulted in very low flower yield in all cultivars and no flower assessments could be conducted. The flowers were chosen at random and were collected evenly among the plants in each experimental unit. When the plants reached 50% bloom the following ratings were conducted in the field:

1. Stem Sturdiness – An overall visual rating of each experimental unit on a scale of 0 to 5 based on whether the stems were upright or collapsed onto the ground. 0 = all stems lying on ground, 1 = 1-20% of stems upright, 2 = 21-40% of stems upright, 3 = 41-60% of stems upright, 4 = 61-80% of stems upright, and 5 = 81-100% of stems upright.
2. Flower colour – Flower petals were compared to a colour chart for later reproduction.

Also at peak bloom in 2011 and 2012, 20 flowers from each experimental unit were harvested just below the first pair of leaves, bundled, and dried in a dark and dry barn with good air flow. In 2013, 10 flowers were chosen for the same assessment. These were then assessed for the following in the laboratory several weeks later:

3. Stem length – the length of the stem from the base to the lowest flower buds
4. Total flower height – the total height of the flower from the base of the stem to the tip of the highest buds. The data from assessment 4 and 5 was used to calculate the flower cluster length from the lowest to the highest buds.
5. Number of flower whorls – a count of the number of whorls (levels) of buds on each stem

6. Number of branches – a count of the number of lateral branches on each stem.
7. Bud colour – dried buds were collected from each cultivar and saved. These were compared to a colour chart.
8. Bud weights (2012 and 2013 only) – the weight of all buds on 20 stems and the weight of 100 dried buds. This allowed for an estimation of the number of buds per stem. This assessment was only conducted for bundles from Farm A in 2012 and Farm B in 2013.

The cultivars at each site were harvested at or just past peak bloom as indicated by weekly rating of the percentage of buds open or dead. Plants were harvested by hand by taking approximately the top 20 cm of stem from all stems on all plants. These were weighed, sealed into 27.5 cm ZipVac vacuum sealer bags using a Cabela's CG-15 vacuum sealer, and stored in a freezer at -20°C.

Frozen samples were sent to the University of Guelph for oil analysis. Between 300 and 500 g of each sample was weighed and steam distilled. The amount of oil collected from each sample was recorded. Oil samples were then analysed with a gas chromatograph/mass-spectrometer for oil quality. Due to limited plant material from some cultivars and some sites only certain samples could be analyzed for oil content using steam distillation. Selected cultivars were compared at all sites. All cultivars with sufficient flower yield were compared at Farm B in 2011 and Farm A in 2012 and 2013, the sites with the most cultivars/replicates with sufficient flower yield to conduct oil distillation at the time.

The remaining samples in 2011 were assessed for oil quality components using solid-phase microextraction (SPME), which is a procedure that requires much less plant material. It is not possible to estimate oil yield using this method. SPME was not conducted for 2012 samples because there was sufficient flower material of each cultivar for oil distillation.

Statistical analysis could not be performed on some of the data due to variability in the number of plants in each site. Where there was sufficient data for analysis, data within the replicated portions of the trial were analysed using the General Analysis of Variance function of Statistix 9. Means were compared using Fisher's Protected LSD Test using a type I error rate of 0.05.

Due to space considerations, not all data is presented in this report, but is available in previous annual reports.

RESULTS AND DISCUSSION

Interpreting Results

Replication of treatments, as was conducted for the top seven cultivars, provides multiple comparisons among treatments and allows for statistical analysis. Statistical analysis provides confidence that the difference between two treatments is not just random chance, but an actual effect of the treatment. Missing data interferes with statistical analysis. Where statistical analysis has been completed, data in the tables is followed by one or more letters. Numbers followed by the same letter are not statistically different. For example, if one number is followed by an “a” and the next is followed by an “ab” then there is no significant difference between the numbers, since they are both followed by an “a”. If one number is followed by an “ab” and the next is followed by a “cd” then they are significantly different. Without a significant difference, two numbers cannot be considered different. The 20 unreplicated cultivars cannot be statistically compared within each site. This data provides some relative comparisons among treatments, but there can be much less confidence when comparing these results. These numbers represent what happened on the particular part of the plot where those plants were located, which may have had a different microclimate or soil condition than another cultivar on the opposite side of the plot. Caution is advised when making conclusions without statistical analysis.

It is also difficult to compare between farms because multiple factors differ at the same time including weather conditions, soil types, mulch, planting and assessment dates, and fertility.

Weather conditions have been highly variable from year to year and site to site. The winters of 2013/2014 and 2014/2015 were extremely cold at all sites, while the winter of 2011/2012 was the warmest. Farm A had significant rainfall in June and July 2013 resulting in nearly saturated conditions for those entire months. The saturation resulted in a *Phytophthora* root rot outbreak that killed off most of an entire block of the trial. This affected some of the yield results from that site.

Plant Size and Shape (Presented in Tables 7-9)

1. Plant ages were variable within and among sites due to establishment issues. Mean plant ages are indicated in the table to provide a better comparison among cultivars and sites.
2. Plant volumes are highly variable among sites and cultivars.
3. The sites with fabric mulch (Farms A, B and C) generally had the largest plants and best overall shape ratings, especially for the lavandins. Farm E also had high size and shape ratings for the *angustifolia* cultivars. This could also be related to the length of the growing season, since farms with the black fabric mulch would likely be warmer throughout the growing season, or related to less competition with weeds or grass, but pruning techniques and/or local weather conditions may also play a role.
4. The highest shape ratings for 2013 were at Farms A and C.

5. Lavandins were generally larger than angustifolias except at Farm D. This is due to much faster plant growth in the initial years of the trials.
6. The largest plants after four years across all sites were Dark Supreme, Betty's Blue, and Purple Bouquet (angustifolias) and Fat Spike Grosso and Grosso (lavandins). Plant size would be related to plant vigour but also to reduced winter kill. Winter damage from the winter of 2013/2014 is not factored into the size assessment and would change the results considerably.

Winter Damage (Presented in Tables 10 and 11)

1. Winter 2010/2011 was relatively cold with steady snow cover until late winter, while winter 2011/2012 was very mild with frequent freeze/thaw cycles
2. A very warm March 2012 resulted in early growth and this was followed by repeated frosts that damaged plants, especially at Farms C, D and E. Most damaged plants grew back from the base, but the damage reduced flower yields and plant size. At the time of the winter damage ratings, some plants appeared dead that later grew back from the base. Low ratings do not necessarily indicate plant death.
3. The winters of 2013/2014 was the longest and coldest in the last two decades in southern Ontario, and due to this plants had the lowest winter survival ratings of the four years.
4. Angustifolia cultivars generally had less winter damage than lavandins except after the mild winter of 2011/2012 when ratings were similar between the two types. Angustifolia cultivars appear to be more susceptible to wet soils and freeze/thaw cycles, while lavandins appear to be more susceptible to cold air temperatures and wind.
5. Folgate had the least winter damage of all cultivars after the winter of 2013/2014 for the fourth year in a row. The cultivars with the least winter damage over the four winters were Folgate, Royal Velvet and Dark Supreme (angustifolias) and Fat Spike Grosso, Edelweiss, and Gros Bleu (lavandins).
6. The lavandins Tuscan Blue, Provence, Alba, Fred Boutin, Impress Purple and the unknown lavandin and the angustifolia Sharon Roberts had lower winter survival ratings across all four years and are not currently recommended for production in Ontario.
7. Winter survival has been unrelated to hardiness zone, and more related to topography, local microclimates and snow cover, since different sites have had the highest winter survival ratings in each of the four years.

Overall Stem and Flower Height (Presented in Table 12)

1. Hidcote Giant, Super and Edelweiss had the tallest flowers of the lavandins, and Royal Purple, Folgate and Royal Velvet had the tallest flowers of the angustifolias.
2. Sharon Roberts, True Hidcote and Melissa had the shortest overall flower height of all cultivars.

Flower Cluster Length (Presented in Table 13)

1. A wide spacing between whorls (levels) of buds results in a longer flower cluster, which is undesirable for flower bundles unless there are a high number of whorls within the flower cluster.
2. Buena Vista, Royal Purple and Royal Velvet had the longest flower clusters of the angustifolias and Edelweiss, Super and Grosso had the longest clusters of the lavandins. However, lavandins generally have more whorls and tightly packed flower clusters.

Number of Flower Whorls (Presented in Table 14)

1. The number of whorls (levels) of buds, combined with the flower cluster length, gives a better indication of the density of buds on the stem.
2. Royal Purple, Royal Velvet and Buena Vista have a similar number of whorls to other cultivars with much longer flower cluster lengths. As a result, the flower clusters on these cultivars are very loose in their appearance.
3. Grosso, Fat Spike Grosso and Edelweiss have a much higher number of whorls per stem which may account for higher oil yield, especially for Grosso.
4. Premier has the fewest whorls resulting in a small flower cluster.

Stem Branching (Presented in Table 15)

1. Side branches on the stem are not desirable because they interfere with flower bundling and give the plant a disorganized appearance.
2. Most cultivars have minimal branching but Impress Purple, Gros Bleu and Edelweiss have at least one side branch on average per stem.

Stem Sturdiness (Presented in Table 16)

1. Stem sturdiness ratings assess the strength of the stem and the plant to hold up the flowers in bloom. High ratings indicate plants that remain upright during bloom, while low ratings indicate plants that collapse under the weight of the flowers. Collapsed flowers are difficult to harvest and can be damaged while lying on the ground.
2. Many angustifolia cultivars have shorter stems which are less likely to collapse. The exception is Buena Vista, Sachet and Provence Blue, which have weaker stems, and Royal Purple, which has taller stems and intermediate stem strength.
3. In 2013, all lavandins at all sites had the highest stem sturdiness rating, showing no issues with flowers collapsing.

Weight and Number of Buds per Stem (Presented in Table 17)

1. Lavandin cultivars have up to three to four times more buds per stem than angustifolia cultivars, which corresponds to much higher weight of buds per stem. This may account for the higher oil volumes from lavandins.
2. Grosso has by far the highest number of buds per stem of all cultivars
3. Lavandins are more suited to dry bud production than angustifolias because a grower can get three times more buds with the same amount of harvest effort.

However, bud colour and scent profiles also should factor into the decision of which cultivar to grow for this purpose.

Bloom Period (Presented in Figures 1 and 2)

1. A mix of early and late blooming cultivars is necessary to extend the bloom period for farms open to the public. Considering the variability in weather conditions among years, a mix of cultivars also reduces the risk that a festival on a fixed date would miss the bloom period entirely.
2. The appearance of plants is generally at its peak during the first two weeks of the bloom period before brown dead flower petals reduce appearance.
3. Bloom periods are estimated based on ratings conducted every 7 to 10 days.
4. The bloom period for 2013 was later than in 2012 due to a cooler spring.
5. All *angustifolia* cultivars bloomed earlier than all *lavandin* cultivars.
6. Both *angustifolia* and *lavandin* cultivars bloomed earliest at Farm A and latest at Farm D. The bloom period of the *angustifolia* cultivars at Farm A was longer than all other sites, probably due to cooler temperatures when they were in bloom. The extended bloom of the *lavandins* at Farm D may have been the result of new growth with delayed flower development.

Flower and Oil Yield (Presented in Tables 18-24)

1. Flower and oil yields are based on a tight plant spacing that leaves very little room between rows and would be representative of a field specifically planted for flower or oil production. Yields would be much less on plantings for agri-tourism with wide spacing between rows.
2. *Lavandin* cultivars have much higher flower and oil yield than *angustifolia* cultivars.
3. Flower and oil yields on a per plant and per hectare basis are misleading for some cultivars with younger plants in 2013 such as Royal Purple, Royal Velvet and Hidcote. Actual oil yields would be higher if only older plants were available.
4. Grosso had by far the highest flower and oil yield of all cultivars. This cultivar is grown world-wide for oil production and it is no surprise that it has the highest yield.
5. Melissa has the highest oil yield of all of the *angustifolia* cultivars. Sachet had the highest oil volume per kilogram of flowers of the *angustifolias* but had lower flower yields, probably due to being younger on average than many other cultivars. Dark Supreme and Buena Vista also had high oil yield for an *angustifolia*.
6. Hidcote Giant had the highest oil yield per kilogram of flowers of all cultivars, but had a lower flower yield than Grosso, resulting in much lower oil yields per hectare or per plant.
7. Provence Blue had the lowest oil yield per kilogram of flowers of all cultivars in 2012 and 2013. Provence Blue was fully established in the first year of the trials, so this is an accurate representation of its overall oil yield by the third year of growth.

8. Comparing six cultivars across the six sites, oil yield per plant was relatively consistent across sites except when plants were very small/young, which lowered yield. Oil yield per hectare was standardized across the sites due to differences in plant spacing at each site. Oil yield per hectare was highest at Farm A for Grosso, Farm B for True Hidcote, Royal Velvet, Dark Supreme and Edelweiss, and Farm C for Folgate.
9. Flower and oil yield when calculated on a per plant or per hectare basis were much higher on Farms A, B and C than the other sites. This is directly related to plant size. Farms A, B and C are the three sites on solid fabric mulch, with no competition with weeds or grass between rows. The mulch may also help to keep soil moisture levels higher at these sites and increase heating in spring and fall, which would extend the growing season. This is supported by observations at Farm B showing much faster growth of the same cultivar planted at the same time on solid fabric mulch compared to fabric mulch in strips with grass between rows.

Oil Quality - Cultivars (Presented in Figures 3 to 14)

1. Oil quality results presented in Figures 3 and 4 are from the 2012 growing season. The graphs also include a few cultivars not in the trial from Farm B in 2011. The results from 2013 are presented in figures 7 and 8.
2. Figures 3 and 7 show the components of the oil that made up >1% of the oil for at least one cultivar. This shows that lavender essential oil is complex and it is difficult to determine quality based on an oil profile alone.
3. The lavandins are high in camphor and this will give the oils a medicinal/clean scent. Camphor masks some of the floral and fruity components that dominate in the angustifolias.
4. The cultivar in the trial with the highest percentage of floral components in both 2012 and 2013 was French Fields. Elegance Ice which was not included in the trial had the highest floral components overall in 2012
5. Maillette and Provence Blue have completely different essential oil profiles than other angustifolias.
6. Hidcote, Imperial Gem and Premier have very low levels of linalool, which has a floral scent for both the 2012 and 2013 data.
7. Super is the lavandin with lowest amount of camphor for 2012 and 2013.
8. Comparing Grosso across all six sites and four replications for 2012 and 2013, the overall components of the oil were consistent, but the proportions of each component had some variability, especially among sites. This suggests that Grosso oil from different sites would have a similar overall character but with subtle differences at each farm. Some of the variability may be due to harvest timing, local weather and soil conditions, and sample handling.
9. Similar differences among sites were observed for the other 5 cultivars analyzed across sites (Folgate, Dark Supreme, True Hidcote, Royal Velvet, and Edelweiss)

Flower and Bud Colour (Presented in Table 25)

1. The overall flower and bud colours presented are based on a colour scale printed on a specific printer. The colours may not be exact if the chart is printed on another printer or viewed on a screen.
2. Both bud and flower colour together give the overall appearance of the cultivar in the field.

CONCLUSIONS

The results of this study provide a wealth of data on how different cultivars perform under Ontario growing conditions. Cultivar may perform differently in different sites and with extreme weather events. Weather conditions have a major impact on many growth factors, particularly bloom period, winter damage, and plant growth.

The decision on which cultivar to grow at a particular site will depend on a range of factors including soil, climate, and most importantly, end use. Certain cultivars are suitable for specific purposes. For example, Hidcote Giant may be the best cultivar to grow for dried bundles due to its stem height, but it doesn't survive the winter well, the oil and flower yields are lower and the oil appears to have lower quality. Super has lower oil yield per hectare than most other lavandins, but has high oil quality.

In all four years of winter damage assessments, Folgate was ranked as the hardiest cultivar of the 27 tested. Folgate also has tall flowers, favourable colour, and good oil quality. While Folgate still has many positive attributes and would still be highly recommended, growth slowed considerably in 2012 and 2013, which may have resulted in a relatively low flower and oil yield per hectare. However, this is based on only one site, and more data analysis is required. Grosso still has to be considered the most promising lavandin cultivar because of its high oil yield and its rapid plant growth. However, all lavandins were significantly damaged over the winter of 2013/2014 and winter protection of all lavandins may be required.

Visual interest and bloom period are also factors to consider if a farm is going to be open to the public. Cultivars that are unsuitable for production of oil might have the best appearance. A range of cultivars is required to extend the bloom period and for contrasting colours. Edelweiss and Melissa appear to be the best cultivars to provide contrasting colours.

Weather conditions during the four winters differed greatly and the relative ranking of many of the cultivars were also very different between the years. However, some cultivars such as Folgate and Fat Spike Grosso showed the least damage over winter in multiple years, although none of the lavandins had acceptable survival in 2014. In 2011 2013 and 2014, angustifolia cultivars appeared to overwinter well in Ontario, but lavandins had much lower overwintering success. The results were very different in 2012, since lavandins actually outperformed angustifolias slightly. Lavandins may be more susceptible to cold, dry air and wind, while angustifolias may be more susceptible to wet soils and freeze/thaw cycles. The cultivars Tuscan Blue, Provence, Alba, Fred Boutin and Sharon Roberts had poor overwintering success in multiple winters, and are not currently recommended for production in Ontario.

Location had a major influence on certain factors such as plant growth, flower and oil yield, and flower characteristics. Plants grown on fabric mulch and sandy soil tended to be larger with the highest yields. These sites were also the warmest sites, and that reduced winter survival in colder winters due to more frequent freeze and thaw cycles and/or lower snow cover.

TABLES AND FIGURES

Table 1. Hardiness zone, weed barrier, soil type, and planting dates for each of the six lavender cultivar trials established across Southern Ontario in 2010.

Farm	Hardiness Zone	Weed Barrier	Soil Type	Planting Dates
A	6b	fabric with wood chips	Harrow sandy loam	June 25, 2010; June 23, 2011; July 21, 2011; Aug. 12, 2011; July 6, 2012; Aug. 27, 2012
B	5b	fabric	Scotland sand	June 25, 2010; June 20, 2011; July 19, 2011; Aug. 8, 2011; June 26, 2012; Aug. 29, 2012
C	5b	fabric	Granby loamy sand	June 29, 2010; June 21, 2011; July 25, 2011; Aug. 8, 2011; June 27, 2012; Aug. 29, 2012
D	5b	plastic	Colwood silt loam	June 25, 2010; June 20, 2011; July 22, 2011; Aug. 8, 2011; July 6, 2012; Aug. 30, 2012
E	5b	none	Miami clay loam	June 28, 2010; June 21, 2011; July 20, 2011; Aug. 9, 2011; June 29, 2012; Aug. 29, 2012
F	5a	none	Milliken loam	July 8, 2010; June 21, 2011; July 26, 2011; Aug. 10, 2011; July 4, 2012; Aug. 28, 2012

Table 2. List of cultivars in provincial cultivar trials with type and supplier.

Cultivar	Type	Supplier	Location
Melissa	angustifolia	Lavender at Stonegate	Oregon
Royal Purple	angustifolia	Lavender at Stonegate	Oregon
Royal Velvet	angustifolia	Lavender at Stonegate	Oregon
True Hidcote	angustifolia	Lavender at Stonegate	Oregon
Hidcote Giant	lavandin	Lavender at Stonegate	Oregon
Grosso	lavandin	Lavender at Stonegate	Oregon
Provence Blue	angustifolia	Richter's Herbs	Ontario
Betty's Blue	angustifolia	Lavender at Stonegate	Oregon
Sachet	angustifolia	Supplier unknown	Washington
Buena Vista	angustifolia	Lavender at Stonegate	Oregon
Dark Supreme	angustifolia	Lavender at Stonegate	Oregon
Folgate	angustifolia	Lavender at Stonegate	Oregon
French Fields	angustifolia	Lavender at Stonegate	Oregon
Imperial Gem	angustifolia	Lavender at Stonegate	Oregon
Sharon Roberts	angustifolia	Supplier unknown	Washington
Impress Purple	angustifolia	Supplier unknown	Washington
Premier	angustifolia	Lavender at Stonegate	Oregon
Purple Bouquet	angustifolia	Lavender at Stonegate	Oregon
Unknown	lavandin	Richter's Herbs	Ontario
Maillette	angustifolia	Supplier unknown	Washington
Alba	lavandin	Lavender at Stonegate	Oregon
Edelweiss	lavandin	Lavender at Stonegate	Oregon
Fat Spike Grosso	lavandin	Lavender at Stonegate	Oregon
Fred Boutin	lavandin	Richter's Herbs	Ontario
Gros Bleu	lavandin	Lavender at Stonegate	Oregon
Provence	lavandin	Lavender at Stonegate	Oregon
Super	lavandin	Lavender at Stonegate	Oregon
Tuscan Blue	lavandin	Lavender at Stonegate	Oregon

Table 3. Soil analysis results for six lavender plot sites across southern Ontario.

Farm	Ph	Organic matter (%)	P Bicarb (ppm)	K (ppm)	Mg (ppm)	Ca (ppm)	CEC (meq/100g)
A	7.5	2.4	108	293	195	3040	17.6
B	6.7	1.6	63	131	95	1000	7.3
C	7.5	4.1	64	141	140	2670	14.9
D	6.4	2.2	36	128	90	890	6.7
E	7.6	2.1	44	149	160	2440	13.9
F	7.7	1.6	28	61	105	3810	20.1

Table 4. Between and in-row spacing of lavender plants at seven sites across southern Ontario.

Farm	In-row spacing (cm)	Between-row spacing (cm)
A	60	120
B	75	120
C	75	120
D	60	180
E	60	300
F	60	90

Table 5. Winter kill analysis dates for the four years at each of the six Ontario farms.

Farm	2011	2012	2013	2014
A	May 28 th	May 17 th	May 3 rd	May 14 th
B	May 24 th	May 14 th	May 6 th	May 21 st
C	May 24 th	May 18 th	May 6 th	May 16 th
D	May 24 th	May 16 th	May 6 th	May 16 th
E	June 1 st	May 18 th	May 7 th	May 21 st
F	June 2 nd	May 24 th	May 8 th	May 20 th

Table 6. Mean daily maximum temperatures and precipitation for the four closest Environment Canada weather stations to the six lavender cultivar trial locations. The closest stations are: Harrow – Farm A; Delhi – Farm B, C, and D; London – Farm E; Toronto-Buttonville Airport – Farm F.

Month	Mean Daily Maximum Temperature (°C)				Precipitation (mm)			
	Harrow	Delhi	London	Toronto-Buttonville	Harrow	Delhi	London	Toronto-Buttonville
2010								
July	29.9	28.7	27.7	28.8	116	79	110	77
Aug.	28.3	27.9	27.4	27.0	9	78	40	91
Sept.	23.1	21.5	20.9	20.9	51	69	108	80
Oct.	17.2	15.2	15.2	14.7	42	97	88	70
Nov.	10.0	9.7	9.1	8.6	85	96	85	71
Dec.	-1.3	-1.5	-2.3	-1.6	72	44	74	39
2011								
Jan.	-2.7	-3.8	-4.1	-3.8	85	74	52	43
Feb.	-0.9	-0.6	-1.7	-1.4	109	87	80	47
Mar.	4.8	3.5	3.0	3.4	100	144	113	113
Apr.	12.3	11.7	11.9	12.1	132	145	114	92
May	19.5	19.2	19.1	18.6	177	113	127	123
June	25.7	24.6	23.8	24.0	73	57	63	96
July	30.0	30.6	29.3	29.7	142	27	46	51
Aug.	26.7	27.1	26.3	26.7	107	88	122	80
Sept.	21.0	21.5	21.3	22.2	176	88	137	94
Oct.	15.8	14.8	14.8	14.6	95	65	99	102
Nov.	10.9	10.7	10.7	10.3	189	108	122	91
Dec.	4.6	4.8	3.9	3.7	83	105	92	50
2012								
Jan.	2.4	1.5 ^z	1.1	1.1	47	39 ^z	72	59
Feb.	3.1	2.4	2.3	2.5	41	37	22	39
Mar.	13.4	13.5	13.0	12.1	53	58	46	24
Apr.	14.1	12.9	12.8	12.1	26	25	30	43
May	22.6	23.5	22.5	22.3	73	28	21	37
June	26.4	25.8	25.9	26.0	29	74	87	99
July	28.9 ^z	29.9	29.6	29.5	62 ^z	19	42	138
Aug.	26.2	26.7	26.8	26.7	87	100	60	84
Sep	22.0	21.5	21.5	21.3	46	92	93	180
Oct.	14.9	14.5	14.5	14.1	51	65	109	111
Nov.	8.0	7.4	7.1	7.1	15	13	14	19
Dec.	4.9	3.9	3.9	3.4	43	63	69	66
2013								
Jan.	1.6	1.3	0.7	1.3	93	106	101	68
Feb.	0.3	-1.3	-1.4	-1.2	67	80	61	60
Mar.	4.3	2.5	2.5	3.8	24 ^y	39	35	21
Apr.	12.1	11.5	11.2	11.0	142 ^y	114	114	99
May	21.4	21.7	20.9	20.9	65 ^y	75	102	81
June	24.1	23.4	23.2	23.6	155 ^y	115	115	167
July	26.0	27.2	26.2	27.0	262 ^y	69 ^z	77	102
Aug.	25.1	26.0	25.0	25.9 ^z	64 ^y	57	40	98 ^z
Sep.	22.4	21.3	21.4	21.0	55 ^y	73	113	79
Oct.	16.8	16.1	16.5	15.3	82 ^y	130	155	103
Nov.	6.5	5.8	5.4	5.9	27	57	51	43
Dec.	0.8	0.0	-1.0	-1.5	35	103	57	72
2014								
Jan.	-3.6 ^z	-4.2 ^z	-4.6 ^z	-4.9	46 ^z	75 ^z	49 ^z	52
Feb.	-3.1	-4.6	-4.9 ^z	-4.2	76	54	49 ^z	57
Mar.	1.6 ^z	-0.1	-0.3 ^z	0.4	39 ^z	33	25 ^z	35
Apr.	14.1 ^z	12.8	12.3	11.2	66 ^y	116	76	89

^z Weather data incomplete for this month and location.

^y Data from the Windsor Airport weather station due to missing data at the Harrow site.

Table 7. Mean size, shape and age of lavender plants at the end of the 2013 growing season at six sites across Southern Ontario.

Farm	Plant Height (cm)	Plant Width (cm)	Plant Volume (cm ³) ^z	Shape Rating ^y	Mean Age ^x (years)
Angustifolia					
A	41	74	110000	3.38	2.74
B	29	53	32000	2.88	3.13
C	34	50	30000	2.95	2.90
D	25	37	16000	2.64	2.51
E	39	47	57000	2.96	2.91
F	32	38	27000	2.66	2.92
Overall	33	50	46000	3.16	2.84
Lavandin					
A	44	75	131000	4.12	2.96
B	30	56	49000	3.84	3.27
C	32	52	48000	4.10	3.10
D	23	35	15000	3.70	2.62
E	36	42	39000	3.21	2.77
F	29	35	21000	3.01	2.93
Overall	32	49	51000	3.66	2.91

^z Plant volume = $(2/3)\pi[(W/2+H)/2]^3 \times (S/5)$ where W = plant width in cm, H = plant height in cm, and S = mean shape rating.

^y Shape rating is a rating on a scale of 1 to 5 based on estimated percentage of a dome filled by the plant: 1=1-21%, 2=21-40%, 3=41-60%, 4=51-80%, and 5 = 81-100%.

^x Plants in each trial were established at different times due to survival issues in 2010. Mean age indicates the average age of the plants at each site.

Table 8. Mean plant size, shape rating and plant age of *Lavandula angustifolia* cultivars in fall 2013 planted at six sites across Southern Ontario.

Cultivar	Type	Plant Height (cm)	Plant Width (cm)	Plant Volume (cm ³) ^z	Shape Rating ^y	Mean Age (years)
Melissa	Ang.	37	56	57000	3.16	3.50
Royal Purple	Ang.	28	46	32000	2.90	2.74
Royal Velvet	Ang.	23	31	12000	2.50	2.09
True Hidcote	Ang.	30	40	30000	2.69	2.59
Provence Blue	Ang.	31	53	38000	3.01	3.80
Betty's Blue	Ang.	39	63	73000	3.08	3.12
Sachet	Ang.	32	53	35000	2.86	2.84
Buena Vista	Ang.	34	52	46000	2.85	3.03
Dark Supreme	Ang.	39	65	78000	3.28	3.05
Folgate	Ang.	31	50	37000	3.31	3.41
French Fields	Ang.	39	59	68000	3.26	3.11
Imperial Gem	Ang.	39	60	66000	3.18	3.03
Sharon Roberts	Ang.	33	46	57000	2.94	2.20
Premier	Ang.	28	35	20000	2.65	2.54
Purple Bouquet	Ang.	40	64	76369	2.92	3.07
Maillette ^x	Ang.	21	22	10000	2.04	1.40
Angustifolia Mean		33	50	46000	3.16	2.84

^z Plant volume = $(2/3)\pi[(W/2)+H/2]^3 \times (S/5)$ where W = plant width in cm, H = plant height in cm, and S = mean shape rating.

^y Shape rating is a rating on a scale of 1 to 5 based on estimated percentage of a dome filled by the plant: 1=1-21%, 2=21-40%, 3=41-60%, 4=51-80%, and 5 = 81-100%.

Table 9. Mean volume, shape rating and plant age of *Lavandula x intermedia* (lavandin) cultivars in fall 2013 planted at six sites across Southern Ontario.

Cultivar	Type	Plant Height (cm)	Plant Width (cm)	Plant Volume (cm ³) ^z	Shape Rating ^y	Mean Age (years)
Hidcote Giant	Lav.	31	48	39000	3.13	3.33
Grosso	Lav.	34	58	70000	4.20	3.35
Impress Purple	Lav.	25	38	24000	3.51	2.33
Unknown	Lav.	33	45	48000	3.94	2.12
Edelweiss	Lav.	34	50	53000	3.78	3.55
Fat Spike Grosso	Lav.	35	59	72000	4.40	3.73
Fred Boutin	Lav.	37	52	68000	3.40	2.70
Gros Bleu	Lav.	28	42	33000	3.22	2.50
Provence	Lav.	36	52	59000	3.45	2.80
Super	Lav.	29	46	42000	3.59	2.80
Tuscan Blue	Lav.	33	49	52000	3.63	2.85
Lavandin Mean		32	49	51000	3.66	2.91

^z Plant volume = $(2/3)\pi[(W/2+H)/2]^3 \times (S/5)$ where W = plant width in cm, H = plant height in cm, and S = mean shape rating.

^y Shape rating is a rating on a scale of 1 to 5 based on estimated percentage of a dome filled by the plant: 1=1-21%, 2=21-40%, 3=41-60%, 4=51-80%, and 5 = 81-100%.

Table 10. Average winter survival ratings over four years for 27 lavender cultivars grown at 6 sites in southern Ontario.

Cultivar	Average Winter Survival Rating ^z				Mean
	2011	2012	2013	2014	
Melissa	8.2	6.4	5.1	2.0	5.4
Royal Purple	7.2	6.4	4.5	3.5	5.4
Royal Velvet	8.3	7.2	4.1	3.4	5.8
True Hidcote	7.6	5.5	3.9	2.8	5.0
Hidcote Giant ^y	6.8	6.8	3.2	0.9	4.4
Grosso ^y	6.5	7.6	4.3	0.9	4.8
Provence Blue	8.2	5.7	2.8	1.9	4.7
Betty's Blue	9.1	6.0	3.3	3.3	5.4
Sachet	--	5.1	3.0	2.2	3.4
Buena Vista	8.9	4.9	2.2	2.0	4.5
Dark Supreme	8.3	5.6	6.1	2.6	5.7
Folgate	9.3	8.5	7.0	4.3	7.3
French Fields	9.0	6.1	5.1	1.9	5.5
Imperial Gem	7.2	6.3	5.5	2.5	5.4
Impress Purple ^y	--	--	1.7	2.0	1.9
Sharon Roberts	--	3.3	4.0	2.5	3.3
Premier	5.0	5.8	3.7	1.1	3.9
Purple Bouquet	8.4	6.0	3.8	2.8	5.3
Unknown Lavandin ^y	--	3.5	3.9	1.0	2.8
Alba ^y	0.3	4.4	--	--	2.4
Maillette ^x	--	--	2.3	3.0	2.7
Edelweiss ^y	7.3	7.4	4.0	1.8	5.1
Fat Spike Grosso ^y	8.4	8.0	4.0	1.6	5.6
Fred Boutin ^y	--	5.1	2.6	0.6	2.8
Gros Bleu ^y	6.7	7.0	4.0	1.8	4.9
Provence ^y	1.3	5.4	1.8	0.8	2.3
Super ^y	5.6	6.6	4.1	0.8	4.3
Tuscan Blue ^y	0.5	4.7	2.9	0.6	2.2
Angustifolia	8.1	5.9	4.2	2.4	4.9
Lavandin	4.8	6.0	3.3	1.2	3.6

^z Scale of 0 to 10: 0 = dead; 1 = 1 – 10% healthy; 2 = 11 – 20% healthy
... 10 = 91-100% healthy.

^y Lavandin (*Lavandula x intermedia*)

^x Alba was replaced by Maillette in 2012.

Table 11. Average winter survival ratings at each site in May 2011, 2012, 2013 and 2014.

Farm	County	All cultivars ¹				Angustifolia ^z				Lavandin ^z			
		2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
A	Essex	5.9	9.0	3.8	2.2	7.6	9.0	3.6	3.2	2.8	9.1	4.2	1.1
B	Norfolk	7.3	9.0	7.1	2.5	8.5	8.8	7.4	3.1	5.7	9.3	6.6	1.1
C	Norfolk	6.7	3.4	4.6	1.9	7.5	2.5	4.7	2.1	5.6	5.1	4.4	0.5
D	Norfolk	7.5	6.6	2.7	0.2	7.8	6.6	2.7	1.2	7.1	6.4	2.6	0.4
E	Elgin	7.8	0.9	1.7	0.7	8.4	1.1	2.2	1.0	7.0	0.4	0.9	0.0
F	York	7.4	7.1	3.3	4.3	8.1	7.3	3.7	4.7	6.5	6.6	2.8	3.7

^z Scale of 0 to 10: 0 = dead; 1 = 1 – 10% healthy; 2 = 11 – 20% healthy ... 10 = 91-100% healthy.

Table 12. Mean overall stem and flower height (base of stem to tip of flower) of lavender cultivars grown at six sites across southern Ontario in 2013.

Cultivar	Height (cm)							All Farms
	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F		
Melissa	30.3 bc	27.4 a	20.8 b	16.4 a	13.9 a	17.2 a	21.0 a	
Royal Purple	32.8 c	33.8 b	32.5 c	26.3 b	30.9 c	28.1 b	30.7 c	
Royal Velvet	31.3 c	30.4 ab	29.1 c	.	22.4 b	25.7 b	27.8 b	
True Hidcote	21.8 a	27.1 a	18.2 a	16.6 a	19.0 b	18.2 a	20.1 a	
Hidcote Giant ^z	61.4 e	60.0 d	49.3 e	44.9 d	48.3 d	28.4 b	48.7 e	
Grosso ^z	45.6 d	52.2 c	43.2 d	36.2 c	44.6 d	40.8 c	43.8 d	
Provence Blue	26.2 ab	27.6 a	20.2 ab	18.5 a	17.6 ab	26.0 b	22.7 a	
Betty's Blue	28.4	31.1	21.1	19.2	20.6	19.0	23.2	
Sachet	22.8	27.7	18.0	20.7	20.3	18.0	21.2	
Buena Vista	32.2	29.3	21.2	23.4	19.8	21.6	24.6	
Dark Supreme	27.5	35.3	27.2	24.6	25.1	18.9	26.4	
Folgate	36.3	35.1	31.9	18.9	28.9	22.1	28.9	
French Fields	28.4	33.0	29.7	24.4	26.2	23.9	27.6	
Imperial Gem	24.4	29.8	22.3	19.9	20.4	18.3	22.5	
Sharon Roberts	23.1	.	16.1	17.3	17.7	17.8	18.4	
Impress Purple ^z	28.8	49.3	42.7	36.1	28.5	36.2	36.9	
Premier	31.2	33.0	25.7	22.2	19.2	22.8	25.7	
Purple Bouquet	27.9	29.9	23.1	23.2	20.2	21.6	24.3	
Unknown ^z	49.2	.	38.1	35.3	35.0	34.2	38.4	
Maillette	.	28.9	22.4	.	.	20.5	23.9	
Edelweiss ^z	45.8	60.0	44.4	39.4	42.2	40.3	45.3	
Fat Spike Grosso ^z	45.7	52.6	43.3	33.7	45.2	45.0	44.3	
Fred Boutin ^z	37.1	.	36.9	34.7	36.0	40.8	37.1	
Gros Bleu ^z	52.8	58.2	42.0	33.8	.	28.6	43.1	
Provence ^z	46.3	56.5	29.1	33.0	33.4	34.8	38.8	
Super ^z	52.1	66.6	47.4	38.1	41.9	30.4	46.1	
Tuscan Blue ^z	49.3	59.1	42.9	34.6	37.2	28.7	42.0	
Overall Mean	36.1	40.6	31.1	27.7	28.6	27.0	31.6	

^z Lavandin

^y Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test. Ns = not significant

Table 13. Mean flower cluster length (distance from lowest to highest buds) of lavender cultivars grown at six sites across southern Ontario in 2013.

Cultivar	Length (cm)						
	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F	All Farms
Melissa	7.3 ab	7.4 b-d	5.7 a	2.9 a	3.0 a	3.8 ab	5.0 ab
Royal Purple	12.2 e	11.3 e	12.8 c	8.7 b	8.3 c	5.7 cd	9.8 d
Royal Velvet	9.4 cd	8.9 d	9.7 b	.	5.3 b	5.2 b-d	7.8 c
True Hidcote	5.9 a	6.7 bc	5.2 a	4.3 a	4.2 ab	3.5 a	5.0 a
Hidcote Giant ^z	9.1 bc	4.8 a	6.4 a	5.2 a	5.1 b	4.1 a-c	5.8 ab
Grosso ^z	11.3 de	7.7 cd	6.2 a	8.2 b	8.4 c	6.6 d	8.1 c
Provence Blue	8.2 a-c	5.8 ab	6.0 a	4.9 a	5.3 b	5.3 b-d	5.9 b
Betty's Blue	7.5	7.3	5.5	5.0	6.7	4.2	6.0
Sachet	6.5	8.4	4.6	4.5	5.0	4.7	5.6
Buena Vista	13.9	14.6	8.5	9.9	8.8	4.1	9.9
Dark Supreme	7.0	11.7	5.5	5.6	5.1	3.7	6.4
Folgate	7.9	7.1	8.4	4.3	5.1	4.1	6.2
French Fields	7.4	7.9	6.2	4.8	7.2	5.1	6.4
Imperial Gem	5.0	5.0	3.3	2.6	3.4	2.8	3.7
Sharon Roberts	5.4	.	3.7	6.8	3.9	4.6	.
Impress Purple ^z	9.9	7.4	4.8	4.6	4.1	4.8	5.9
Premier	4.6	6.5	3.3	5.1	2.5	3.1	4.2
Purple Bouquet	6.9	7.5	5.2	5.7	6.4	5.3	6.2
Unknown ^z	8.6	.	5.7	5.4	6.2	4.7	.
Maillette	.	7.2	5.6	.	.	4.3	.
Edelweiss ^z	11.0	13.0	8.0	8.2	7.3	6.7	9.0
Fat Spike Grosso ^z	9.9	11.6	6.0	5.6	7.5	5.6	7.7
Fred Boutin ^z	8.2	.	6.6	8.3	6.1	5.4	.
Gros Bleu ^z	12.1	6.7	7.5	6.3	.	6.2	.
Provence ^z	8.6	9.6	5.5	6.8	5.1	4.8	6.7
Super ^z	12.0	14.0	7.7	8.4	7.1	4.5	8.9
Tuscan Blue ^z	7.4	8.9	7.6	6.0	6.7	2.8	6.6
Overall Mean	8.6	8.6	6.3	5.9	5.7	4.7	6.6

^z Lavandin

^y Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test. Ns = not significant

Table 14. Mean number of cymes (levels of flowers) per stem for lavender cultivars grown at six sites across southern Ontario in 2013.

Cultivar	Number of Cymes						
	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F	All Farms
Melissa	6.2 a	6.2 a	5.9 a	4.9 a	5.2 a	5.4 a	5.6 a
Royal Purple	8.5 c	8.2 c	8.5 d	7.1 b	7.7 c	6.3 a-c	7.7 d
Royal Velvet	6.8 a	7.7 bc	8.0 cd	.	6.4 b	6.6 bc	7.1 c
True Hidcote	6.4 a	7.3 bc	6.7 ab	6.7 b	6.3 b	5.9 ab	6.6 b
Hidcote Giant ^z	7.5 b	6.8 ab	7.2 bc	7.1 b	7.0 bc	7.3 c	7.1 c
Grosso ^z	12.2 d	11.0 d	10.4 e	10.9 c	11.6 d	10.8 d	11.1 e
Provence Blue	6.3 a	6.1 a	5.8 a	5.2 a	6.3 b	5.7 ab	5.9 a
Betty's Blue	6.3	6.7	6.4	5.8	6.5	5.9	6.3
Sachet	6.0	6.3	5.5	5.6	5.4	5.9	5.8
Buena Vista	7.3	8.0	7.2	6.9	6.7	5.9	7.0
Dark Supreme	5.5	6.3	5.9	5.5	5.3	5.1	5.6
Folgate	6.1	6.1	6.2	4.8	5.5	5.1	5.6
French Fields	4.5	4.5	4.4	4.1	4.9	4.7	4.5
Imperial Gem	5.2	5.6	4.9	4.8	4.8	5.8	5.2
Sharon Roberts	5.8	.	5.9	6.4	5.9	6.8	6.2
Impress Purple ^z	8.5	7.7	7.0	6.0	6.5	7.2	7.2
Premier	4.2	3.9	3.4	3.8	3.1	3.5	3.7
Purple Bouquet	6.8	6.6	5.9	6.7	6.6	6.3	6.5
Unknown ^z	9.4	.	8.5	7.6	8.1	8.0	8.3
Maillette	.	8.3	7.4	.	.	7.6	7.8
Edelweiss ^z	10.4	9.7	9.0	8.7	8.1	8.2	9.0
Fat Spike Grosso ^z	12.6	12.2	10.5	9.4	11.6	10.6	11.2
Fred Boutin ^z	9.6	.	9.3	9.4	9.0	8.5	9.2
Gros Bleu ^z	12.1	9.2	10.5	10.0	.	10.9	10.5
Provence ^z	8.7	8.9	8.1	9.0	8.0	8.6	8.6
Super ^z	8.1	8.7	7.3	8.5	6.8	7.0	7.7
Tuscan Blue ^z	8.9	9.5	9.8	8.7	8.9	6.0	8.6
Overall Mean	7.7	7.6	7.2	6.9	6.9	6.9	7.2

^z Lavandin

^y Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test. Ns = not significant

Table 15. Mean number of branches per stem of lavender cultivars grown at six sites across southern Ontario in 2013.

Cultivar	Number of Branches per Stem						All Farms
	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F	
Melissa	0.4 a	0.3 a	0.2 a	0.0 a	0.1 a	0.0 a	0.2 a
Royal Purple	0.1 a	0.1 a	0.0 a	0.3 ab	0.0 a	0.0 a	0.1 a
Royal Velvet	0.0 a	0.6 ab	0.2 a	.	0.1 a	0.0 a	0.2 a
True Hidcote	0.0 a	0.5 ab	0.0 a	0.0 a	0.0 a	0.0 a	0.1 a
Hidcote Giant ^z	1.2 b	1.0 b	1.5 b	0.7 b	0.4 b	0.2 b	0.8 b
Grosso ^z	1.1 b	1.0 b	1.0 b	0.7 b	1.3 c	0.3 b	0.9 b
Provence Blue	0.3 a	0.0 a	0.0 a	0.1 a	0.0 a	0.0 a	0.1 a
Betty's Blue	0.8	0.0	0.0	0.0	0.0	0.0	0.1
Sachet	0.7	1.0	0.0	0.0	0.0	0.0	0.3
Buena Vista	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dark Supreme	0.0	1.0	0.0	0.0	0.0	0.0	0.2
Folgate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
French Fields	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Imperial Gem	0.7	0.0	0.0	0.0	0.0	0.0	0.1
Sharon Roberts	0.2	.	0.0	0.0	0.0	0.0	0.0
Impress Purple ^z	0.8	4.4	2.2	2.0	1.5	1.1	2.0
Premier	0.0	1.4	0.0	0.0	0.0	0.0	0.2
Purple Bouquet	1.1	0.0	0.0	0.2	0.0	0.0	0.2
Unknown ^z	0.8	.	1.0	1.6	0.6	0.2	0.8
Maillette	.	1.4	0.3	.	.	0.0	0.6
Edelweiss ^z	1.7	1.8	0.7	1.0	1.1	0.0	1.1
Fat Spike Grosso ^z	1.2	0.7	1.4	0.2	1.0	0.1	0.8
Fred Boutin ^z	0.4	.	0.8	0.8	1.1	0.0	0.6
Gros Bleu ^z	2.5	1.2	2.2	1.0	.	0.1	1.4
Provence ^z	1.0	1.8	0.9	0.7	0.8	0.0	0.9
Super ^z	1.5	2.4	1.2	0.4	0.2	0.0	1.0
Tuscan Blue ^z	1.7	1.1	1.1	0.5	0.7	0.0	0.9
Overall Mean	0.7	0.9	0.5	0.4	0.3	0.1	0.5

^z Lavandin

^y Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test. Ns = not significant

Table 16. Stem sturdiness ratings for 27 lavender cultivars grown at six sites across southern Ontario in 2013.

Cultivar	Stem Sturdiness Rating ^z						All Farms
	Farm A	Farm B	Farm C	Farm D	Farm E	Farm F	
Melissa	5.0 c	5.0 b	5.0 b	4.3 ^{ns}	5.0 ^{ns}	5.0 b	4.9 c
Royal Purple	4.5 b	5.0 b	4.3 a	5.0	5.0	4.0 a	4.6 b
Royal Velvet	4.8 c	5.0 b	4.8 b	5.0	5.0	5.0 b	4.9 c
True Hidcote	5.0 c	5.0 b	5.0 b	5.0	5.0	5.0 b	5.0 c
Hidcote Giant ^y	5.0 c	5.0 b	5.0 b	5.0	5.0	5.0 b	5.0 c
Grosso ^y	5.0 c	5.0 b	5.0 b	5.0	5.0	5.0 b	5.0 c
Provence Blue	3.5 a	4.0 a	4.0 a	4.3	4.5	3.0 a	3.9 a
Betty's Blue	5.0	4.0	5.0	4.0	5.0	4.0	4.5
Sachet	3.0	4.0	5.0	3.0	5.0	2.0	3.7
Buena Vista	4.0	3.0	4.0	3.0	4.0	2.0	3.3
Dark Supreme	4.0	5.0	5.0	4.0	5.0	5.0	4.7
Folgate	4.0	4.0	4.0	4.0	5.0	4.0	4.2
French Fields	4.0	4.0	5.0	4.0	5.0	5.0	4.5
Imperial Gem	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Sharon Roberts	5.0	.	5.0	4.0	5.0	5.0	4.8
Impress Purple ^y	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Premier	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Purple Bouquet	5.0	4.0	5.0	5.0	5.0	3.0	4.5
Unknown ^y	5.0	.	5.0	5.0	5.0	5.0	5.0
Maillette	5.0	.	5.0	5.0	5.0	.	5.0
Edelweiss ^y	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Fat Spike Grosso ^y	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Fred Boutin ^y	5.0	.	5.0	5.0	5.0	5.0	5.0
Gros Bleu ^y	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Provence ^y	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Super ^y	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Tuscan Blue ^y	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Overall Mean	4.7	4.8	4.8	4.7	4.9	4.5	4.7

^z An overall visual rating of each experimental unit on a scale of 0 to 5 based on whether the stems were upright or collapsed onto the ground. 0 = all stems lying on ground, 1 = 1-20% of stems upright, 2 = 21-40% of stems upright, 3 = 41-60% of stems upright, 4 = 61-80% of stems upright, and 5 = 81-100% of stems upright.

^y Lavandin

^x Numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD Test. Ns = not significant

Table 17. Estimated 100 bud weight, weight of buds per stem and estimated number of buds per stem for 27 lavender cultivars grown at various sites across southern Ontario in 2013.

Cultivar	100 bud weight (g)	Bud weight per stem (g)	Estimated buds per stem
Melissa	0.28	0.12	45
Royal Purple	0.29	0.13	45
Royal Velvet	0.30	0.13	44
True Hidcote	0.21	0.08	40
Hidcote Giant ^y	0.30	0.32	107
Grosso ^y	0.20	0.29	145
Provence Blue	0.24	0.08	33
Betty's Blue	0.23	0.11	49
Sachet	0.29	0.10	36
Buena Vista	0.16	0.07	48
Dark Supreme	0.25	0.16	62
Folgate	0.30	0.10	33
French Fields	0.25	0.12	46
Imperial Gem	0.30	0.15	48
Sharon Roberts	0.30	0.12	38
Impress Purple ^y	0.30	0.27	89
Premier	0.31	0.12	40
Purple Bouquet	0.30	0.16	53
Unknown ^y	0.28	0.15	52
Maillette	0.31	0.13	41
Edelweiss ^y	0.20	0.22	108
Fat Spike Grosso ^y	0.30	0.24	81
Fred Boutin ^y	0.25	0.17	67
Gros Bleu ^y	0.30	0.19	63
Provence ^y	0.30	0.18	60
Super ^y	0.28	0.22	80
Tuscan Blue ^y	0.28	0.20	72
Overall Mean	0.27	0.16	60

^z An estimated number based on the weight of 100 buds and the weight of all buds on 20 stems.

^y Lavandin

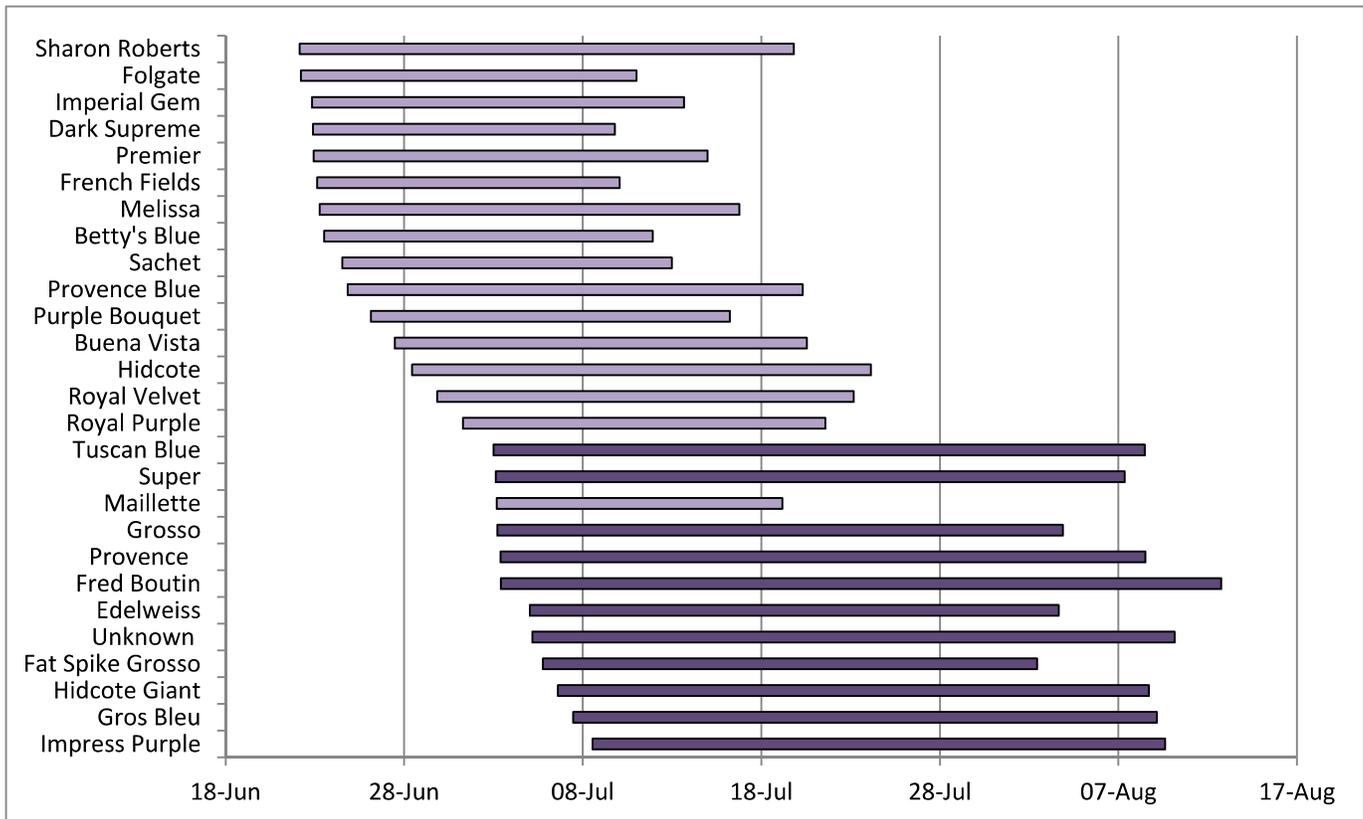


Figure 1. Mean calculated bloom periods in 2013 for 27 lavender cultivars across six sites in southern Ontario. Bloom period start and end dates were calculated based on 2 to 3 assessments within the bloom period. Darker purple bars indicate lavandin cultivars.

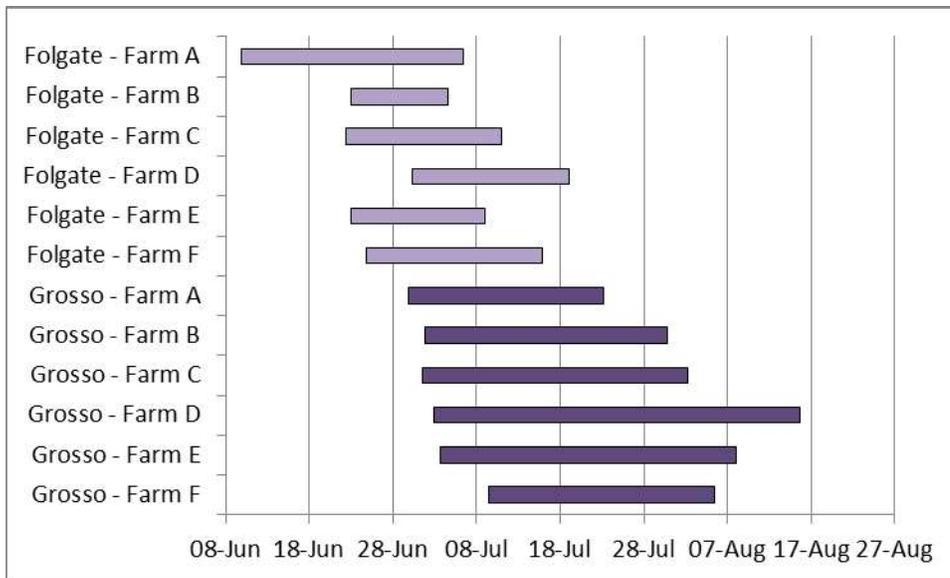


Figure 2. Comparison of calculated bloom period among farms in 2013 for two reference cultivars ‘Folgate’ (angustifolia) and ‘Grosso’ (lavandin). Bloom period start and end dates were calculated based on 2 to 3 assessments within the bloom period.

Table 18. Flower and oil yield of lavender cultivars at Farm A in 2013 based on a per plant and per hectare basis (60 cm in row and 120 cm between row spacing).

Cultivar	Type	Flower Yield			Oil Yield	
		Per plant (g)	Per hectare (kg)	Per kg flowers (ml)	Per plant (ml) ^z	Per hectare (L) ^z
Melissa	angustifolia	453	5030	7.8	3.7	50.8
Royal Purple	angustifolia	433	4810	2.6	1.0	14.2
Royal Velvet	angustifolia	169	1880	3.6	0.6	8.7
True Hidcote	angustifolia	77	861	7.0	0.8	11.2
Hidcote Giant	lavandin	485	5390	16.5	7.9	110.0
Grosso	lavandin	1040	11500	14.8	15.2	211.0
Provence Blue	angustifolia	459	5100	1.9	0.8	11.4
Betty's Blue	angustifolia	243	2700	2.0	0.5	6.8
Sachet	angustifolia	134	1490	12.5	1.7	23.3
Buena Vista	angustifolia	280	3110	6.0	1.7	23.3
Dark Supreme	angustifolia	365	4060	5.6	2.0	28.4
Folgate	angustifolia	240	2670	3.0	0.7	10.0
French Fields	angustifolia	263	2930	5.4	1.4	19.7
Imperial Gem	angustifolia	152	1690	5.0	0.8	10.6
Sharon Roberts	angustifolia	178	1970	4.3	0.8	10.6
Impress Purple	lavandin	515	5720	12.4	6.4	88.7
Premier	angustifolia	180	2000	4.0	0.7	10.0
Purple Bouquet	angustifolia	233	2590	5.3	1.2	17.2
Unknown	lavandin	365	4060	9.8	3.6	49.7
Maillette	angustifolia
Edelweiss	lavandin	430	4780	7.4	3.2	44.2
Fat Spike Grosso	lavandin	610	6780	12.0	7.3	102.0
Fred Boutin	lavandin	350	3890	8.5	3.0	41.5
Gros Bleu	lavandin	320	3560	10.2	3.3	45.3
Provence	lavandin	277	3070	13.0	3.6	50.0
Super	lavandin	290	3220	13.0	3.8	52.4
Tuscan Blue	lavandin	300	3330	12.7	3.8	52.9

^z Flowers for some cultivars were collected from first year plants, which would have much lower yield (e.g. Royal Velvet, Royal Purple). For these cultivars the oil yield per kg flowers provides a better comparison.

Table 19. Flower and oil yield of Grosso lavender at six sites across southern Ontario in 2013.

Farm	Flower Yield			Oil Yield	
	Per plant (g)	Per hectare (kg)	Per kg flowers (ml)	Per plant (ml)	Per hectare standardized (L) ^z
A	1040	11500	14.8	15.2	169.0
B	985	10900	12.9	12.8	142.0
C	665	73900	13.8	8.9	99.0
D	312	3500	15.4	4.8	53.0
E	393	4400	17.6	6.9	76.0
F	131	1500	11.8	1.7	19.0

^z Most sites have different plant spacing, often with large spaces between rows. As a result, yields per hectare are much lower at some sites than they otherwise would be. The standardized calculation assumes the same plant spacing at all sites, which is the spacing used at Farms B and C.

Table 20. Flower and oil yield of True Hidcote lavender at six sites across southern Ontario in 2013.

Farm	Flower Yield			Oil Yield	
	Per plant (g)	Per hectare (kg)	Per kg flowers (ml)	Per plant (ml)	Per hectare standardized (L) ^z
A	78	861	7.0	0.8	8.9
B	453	5030	8.4	3.8	42.0
C	210	2330	4.9	1.0	11.1
D	52	582	5.1	0.1	1.4
E	118	1310	6.0	0.7	7.9
F	26	283	4.5	0.2	1.8

^z Most sites have different plant spacing, often with large spaces between rows. As a result, yields per hectare are much lower at some sites that they otherwise would be. The standardized calculation assumes the same plant spacing at all sites, which is the spacing used at Farms B and C.

Table 21. Flower and oil yield of Royal Velvet lavender at six sites across southern Ontario in 2013.

Farm	Flower Yield			Oil Yield	
	Per plant (g)	Per hectare (kg)	Per kg flowers (ml)	Per plant (ml)	Per hectare standardized (L) ^z
A	170	1880	3.6	0.6	7.0
B	248	2760	4.6	1.1	11.8
C	123	1360	4.5	0.7	7.9
D	125	1390	4.3	0.4	4.3
E	16	177	4.1	0.0	0.2
F	18	202	4.0	0.1	0.6

^z Most sites have different plant spacing, often with large spaces between rows. As a result, yields per hectare are much lower at some sites that they otherwise would be. The standardized calculation assumes the same plant spacing at all sites, which is the spacing used at Farms B and C.

Table 22. Flower and oil yield of Dark Supreme lavender at six sites across southern Ontario in 2013.

Farm	Flower Yield			Oil Yield	
	Per plant (g)	Per hectare (kg)	Per kg flowers (ml)	Per plant (ml)	Per hectare standardized (L) ^z
A	365	4060	5.6	2.0	22.7
B	71	7890	8.2	5.8	64.7
C	198	2190	4.5	0.9	9.9
D	68	755	7.5	0.5	5.7
E	178	1970	8.0	1.4	15.8
F	88	972	5.5	0.5	5.4

^z Most sites have different plant spacing, often with large spaces between rows. As a result, yields per hectare are much lower at some sites that they otherwise would be. The standardized calculation assumes the same plant spacing at all sites, which is the spacing used at Farms B and C.

Table 23. Flower and oil yield of Folgate lavender at six sites across southern Ontario in 2013.

Farm	Flower Yield			Oil Yield	
	Per plant (g)	Per hectare (kg)	Per kg flowers (ml)	Per plant (ml)	Per hectare standardized (L) ^z
A	240	2670	3.0	0.7	8.0
B	420	4670	3.0	1.3	14.0
C	253	2810	7.4	1.9	20.8
D	76	840	8.0	0.6	6.7
E	203	2250	4.4	0.9	9.8
F	154	1710	6.0	0.9	10.3

^z Most sites have different plant spacing, often with large spaces between rows. As a result, yields per hectare are much lower at some sites that they otherwise would be. The standardized calculation assumes the same plant spacing at all sites, which is the spacing used at Farms B and C.

Table 24. Flower and oil yield of Edelweiss lavender at six sites across southern Ontario in 2013.

Farm	Flower Yield			Oil Yield	
	Per plant (g)	Per hectare (kg)	Per kg flowers (ml)	Per plant (ml)	Per hectare standardized (L) ^z
A	430	4780	7.4	3.2	35.4
B	970	10800	10.2	9.9	110.0
C	480	5330	11.4	5.5	60.8
D	243	2690	11.4	2.8	30.7
E	185	2060	15.0	2.9	30.8
F	50	556	5.5	0.3	3.0

^z Most sites have different plant spacing, often with large spaces between rows. As a result, yields per hectare are much lower at some sites that they otherwise would be. The standardized calculation assumes the same plant spacing at all sites, which is the spacing used at Farms B and C.

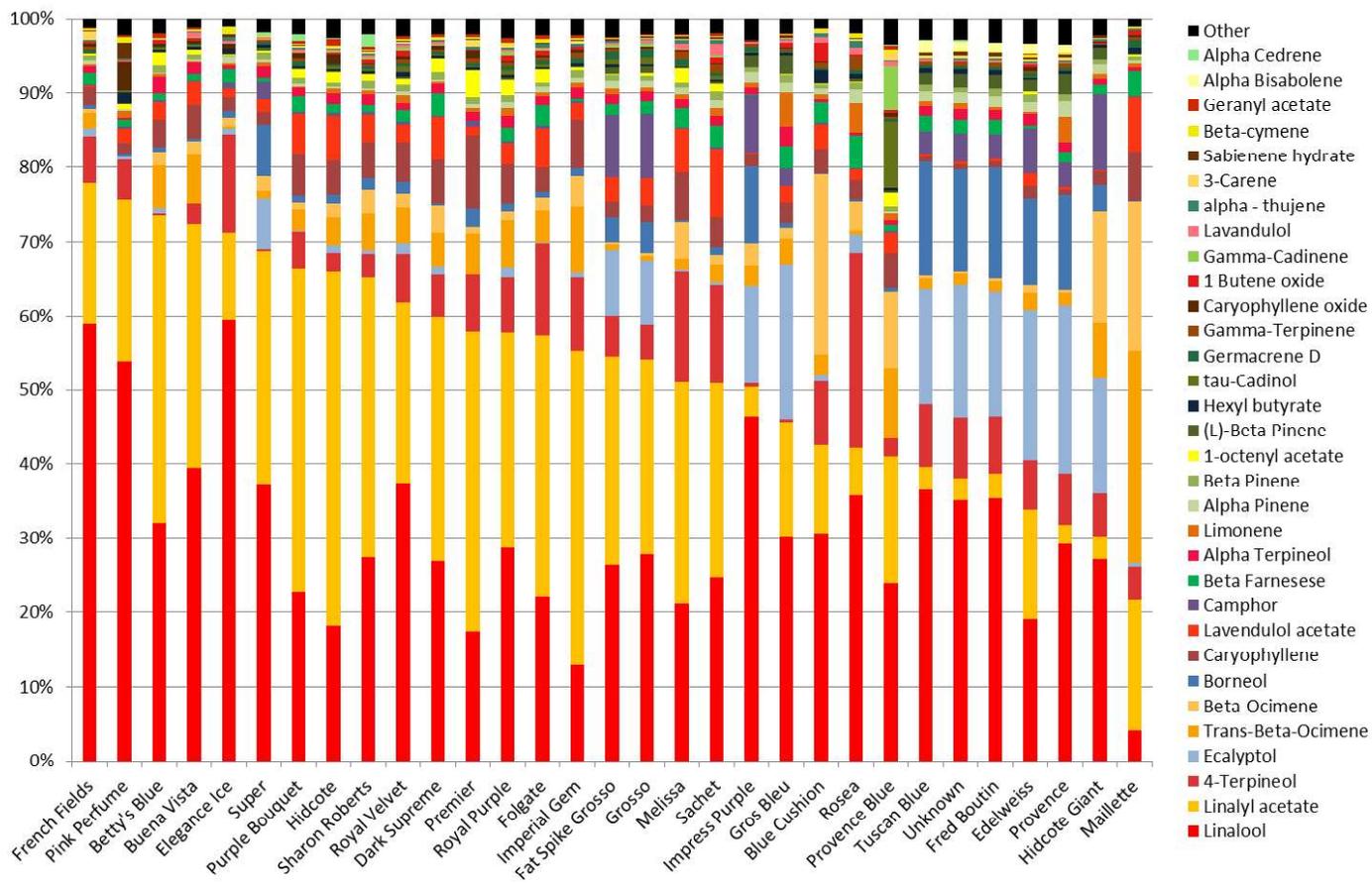


Figure 3. Essential oil profiles of the 27 lavender cultivars included in the cultivar trial taken from Farm A in 2012. The additional cultivars Elegance Ice, Rosea, Blue Cushion and Pink Perfume were taken from Farm B in 2011. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

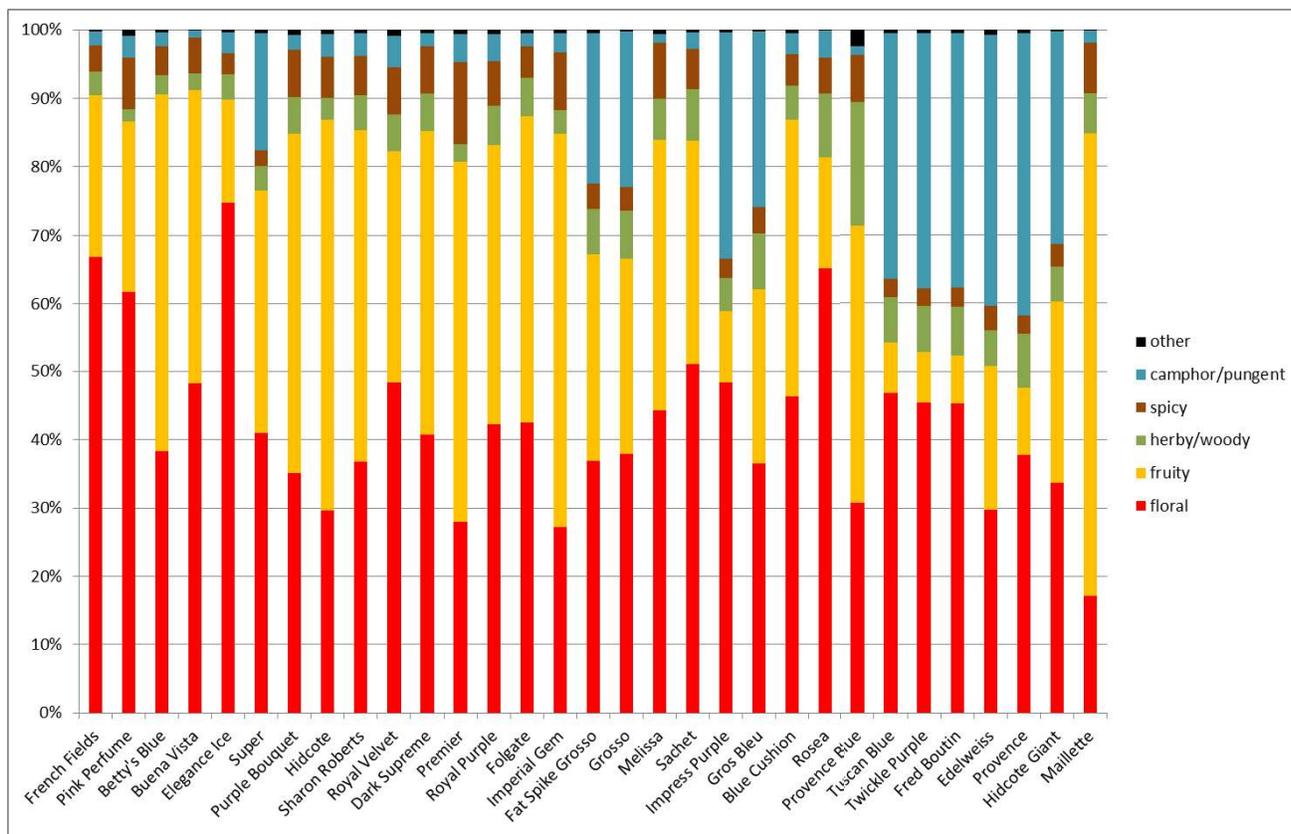


Figure 4. Essential oil profiles of the 27 lavender cultivars included in the cultivar trial taken from Farm A in 2012 with the components divided among different scent categories. The additional cultivars Elegance Ice, Rosea, Blue Cushion and Pink Perfume were taken from Farm B in 2011.

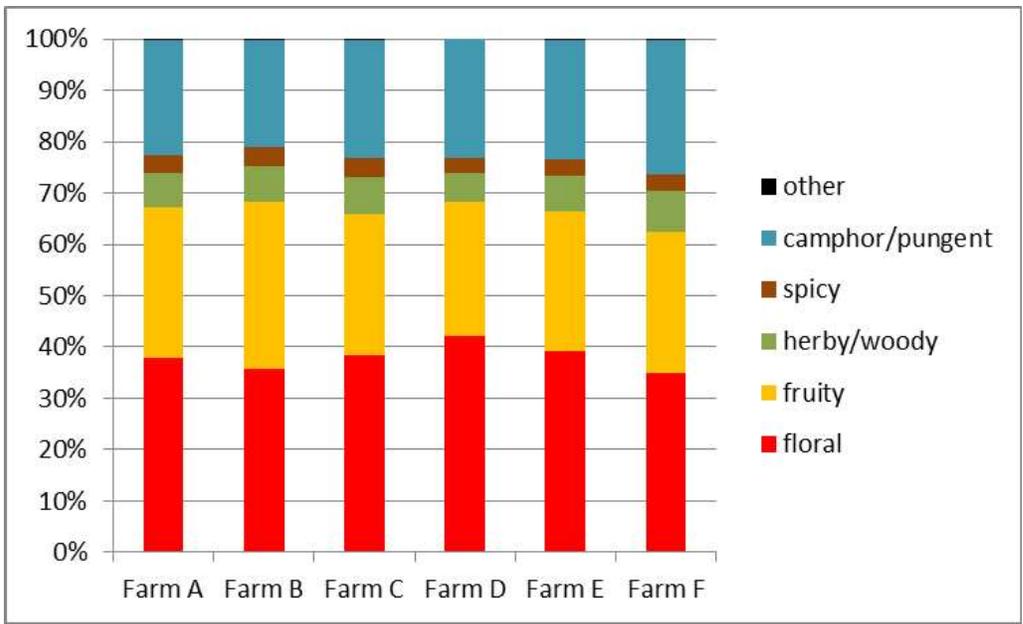


Figure 5. Essential oil profile of Grosso lavender across six sites in southern Ontario in 2012 with components divided into five approximate scent categories.

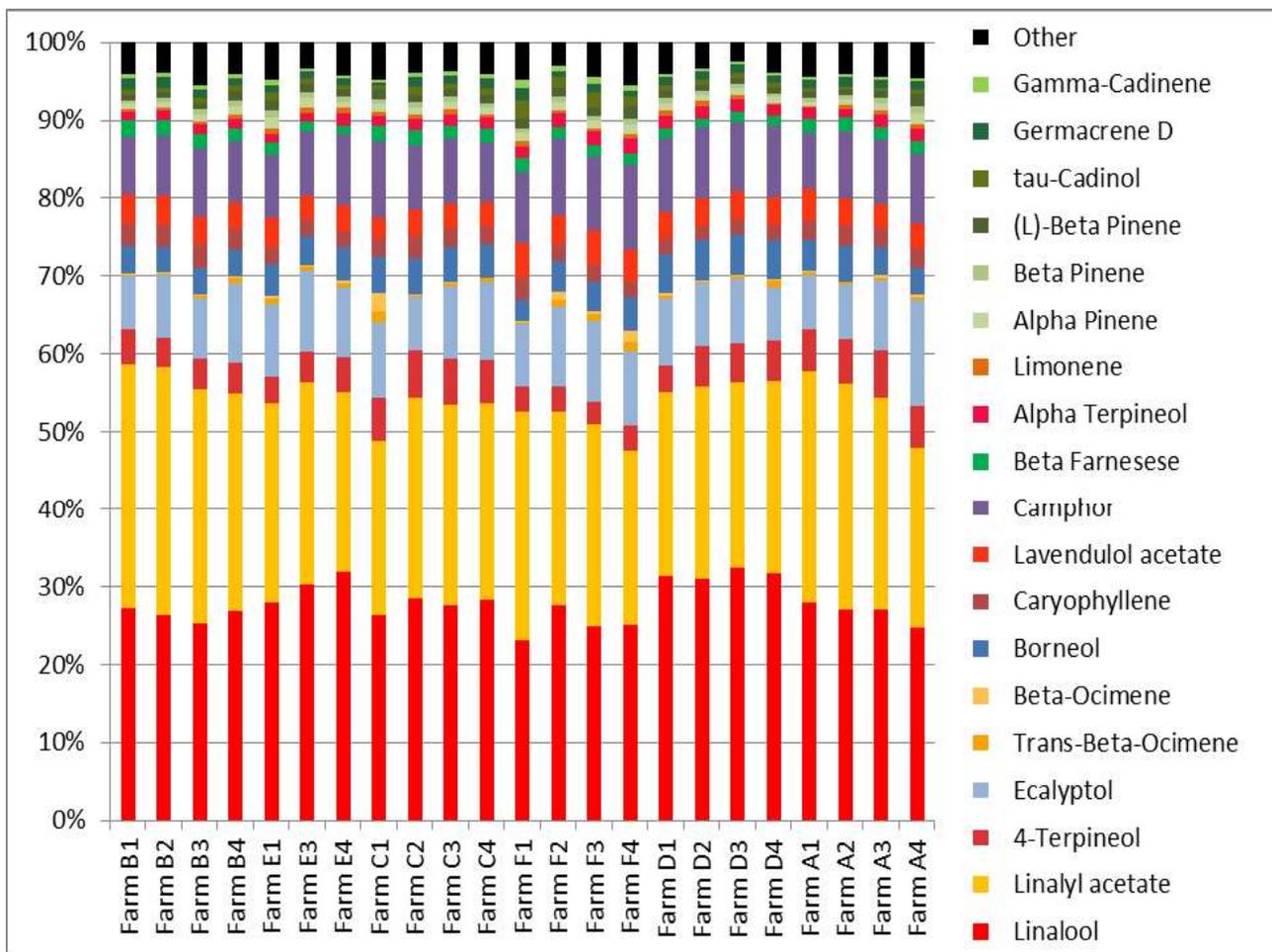


Figure 6. Essential oil profile of Grosso lavender from 2012, across four replications at six sites in southern Ontario. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

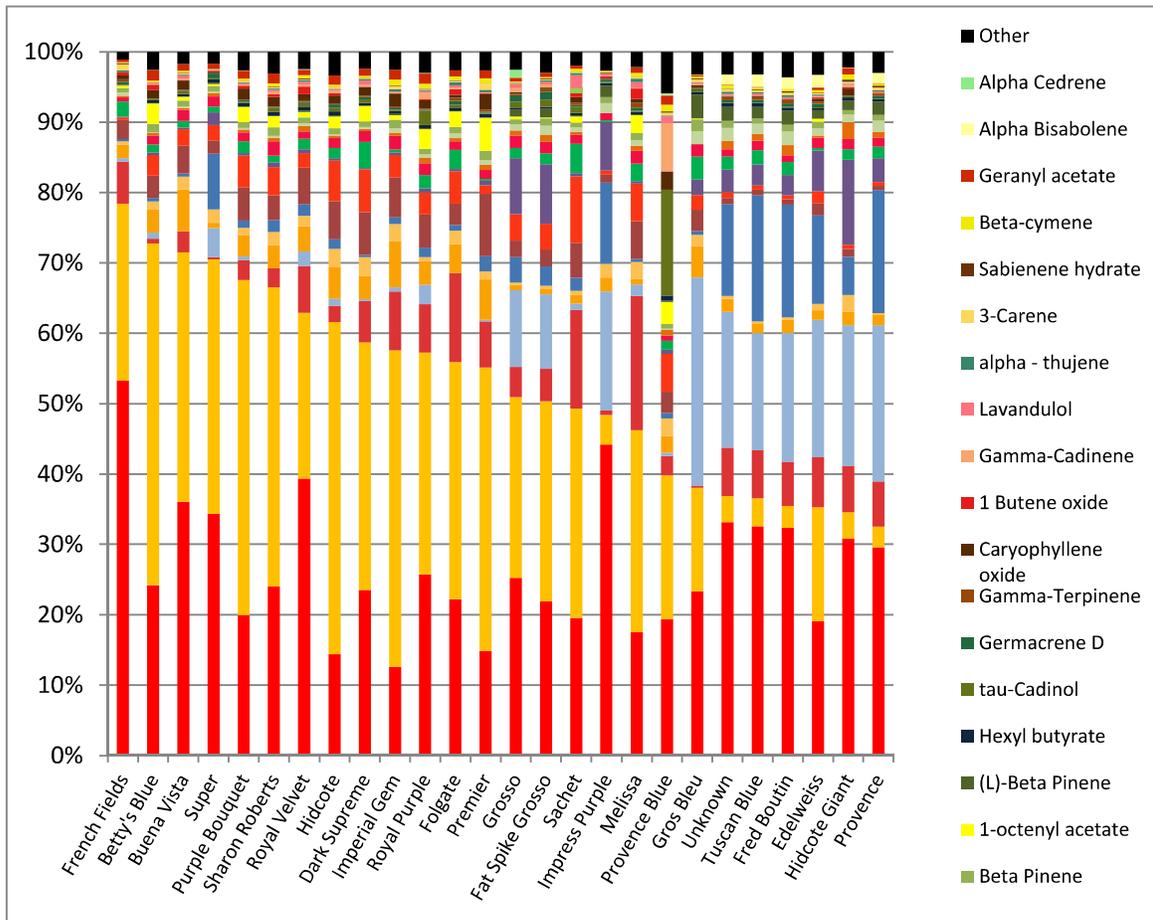


Figure 7. Essential oil profiles of the 26 lavender cultivars from 2013. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

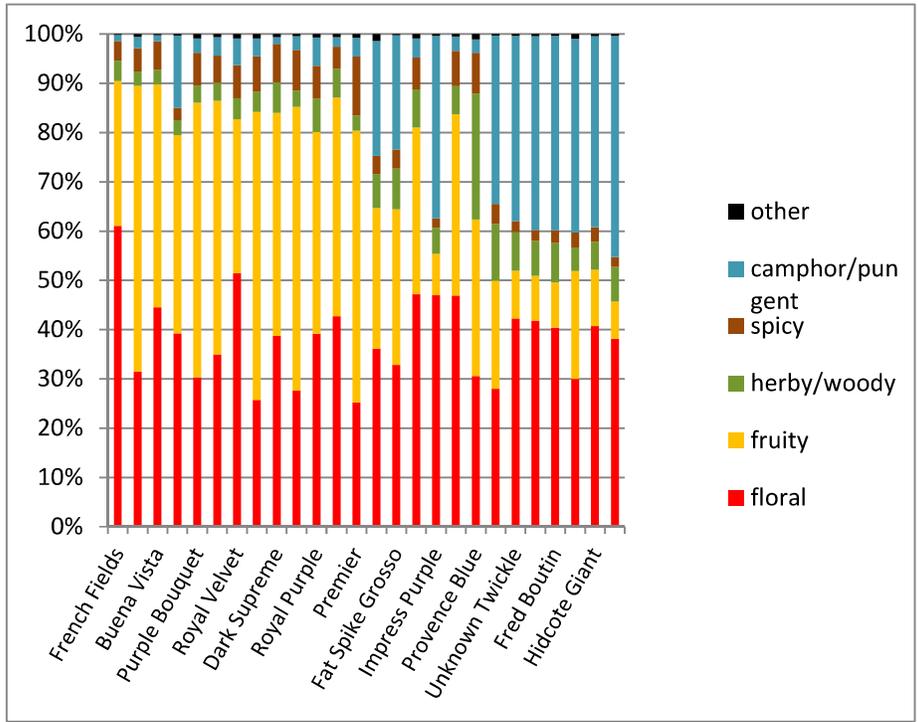


Figure 8. Essential oil profiles of the 26 lavender cultivars from 2013 with the components divided among different scent categories.

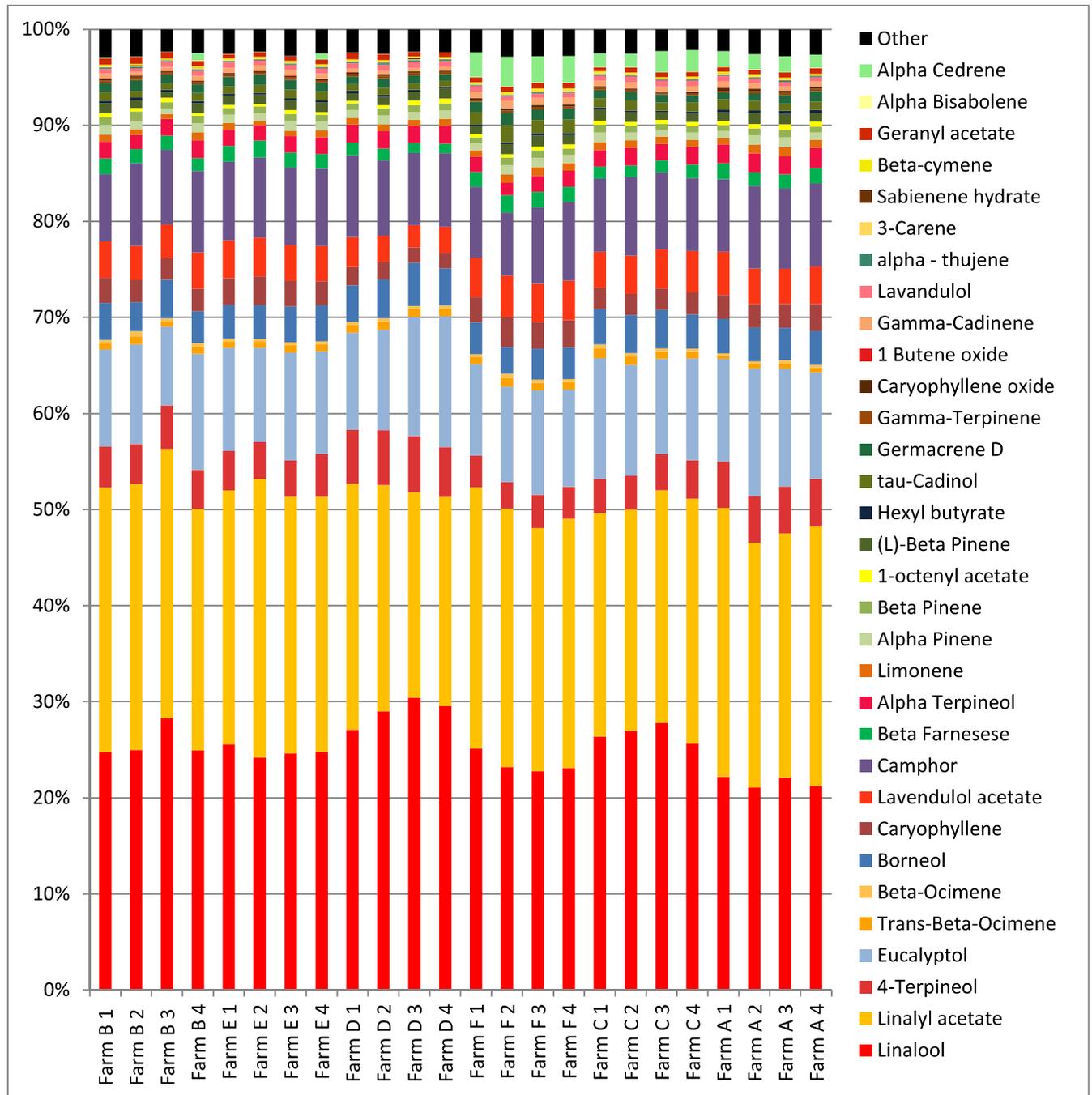


Figure 9. Essential oil profile of Grosso lavender from 2013, across four replications at six sites in southern Ontario. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

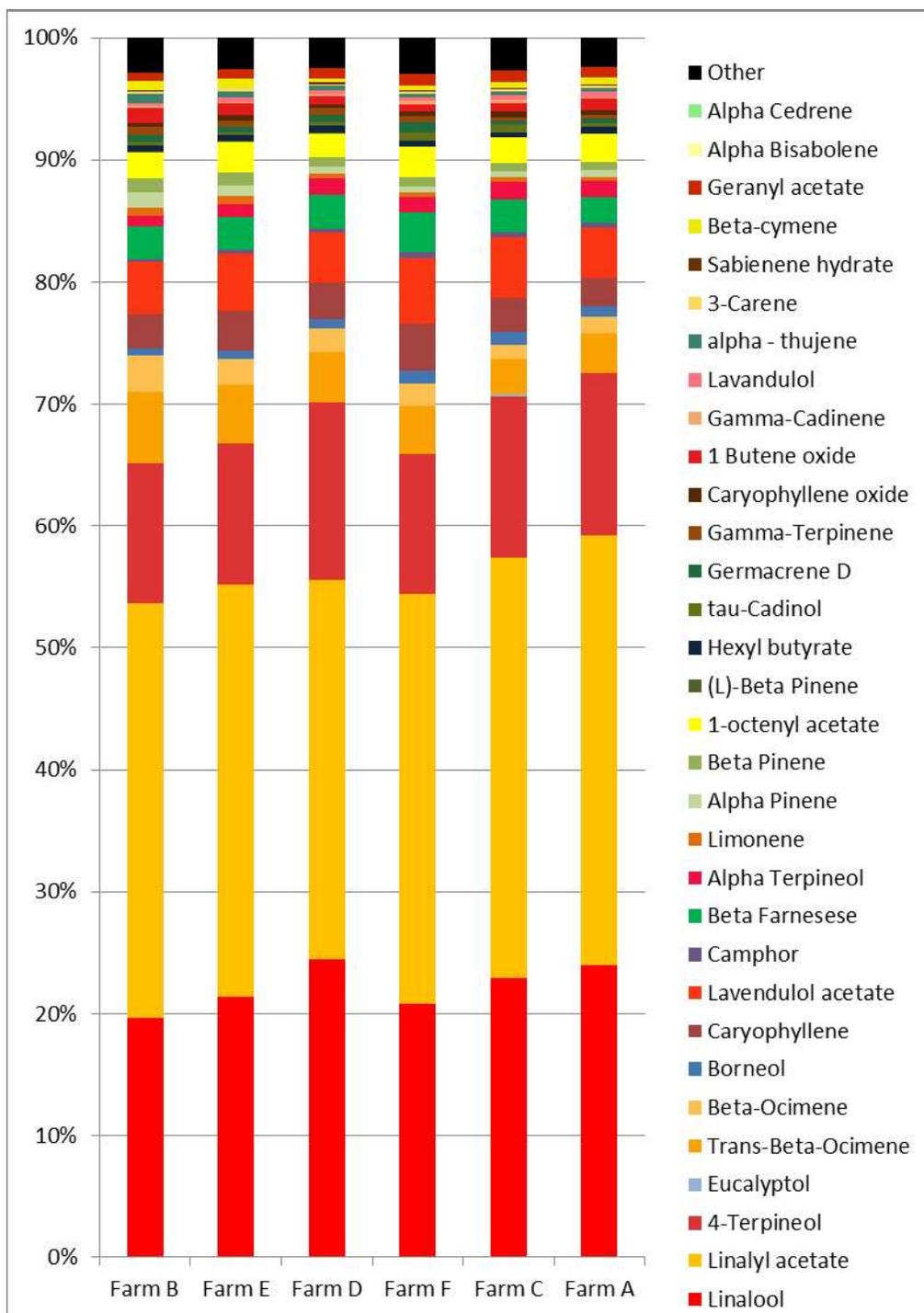


Figure 10. Essential oil profile of Folgate lavender from 2013, across one replication at six sites in southern Ontario. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

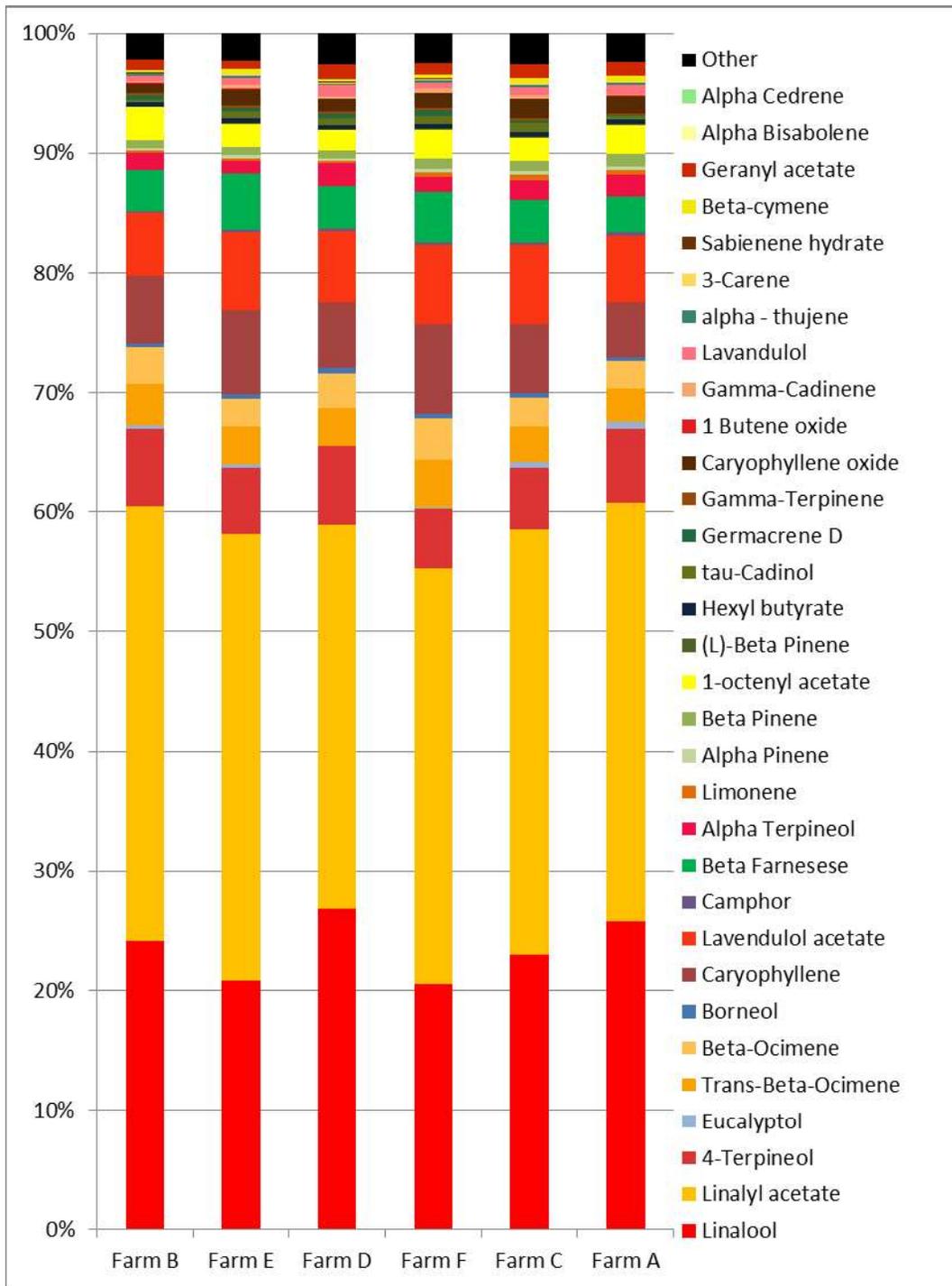


Figure 11. Essential oil profile of Dark Supreme lavender from 2013, across one replication at six sites in southern Ontario. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

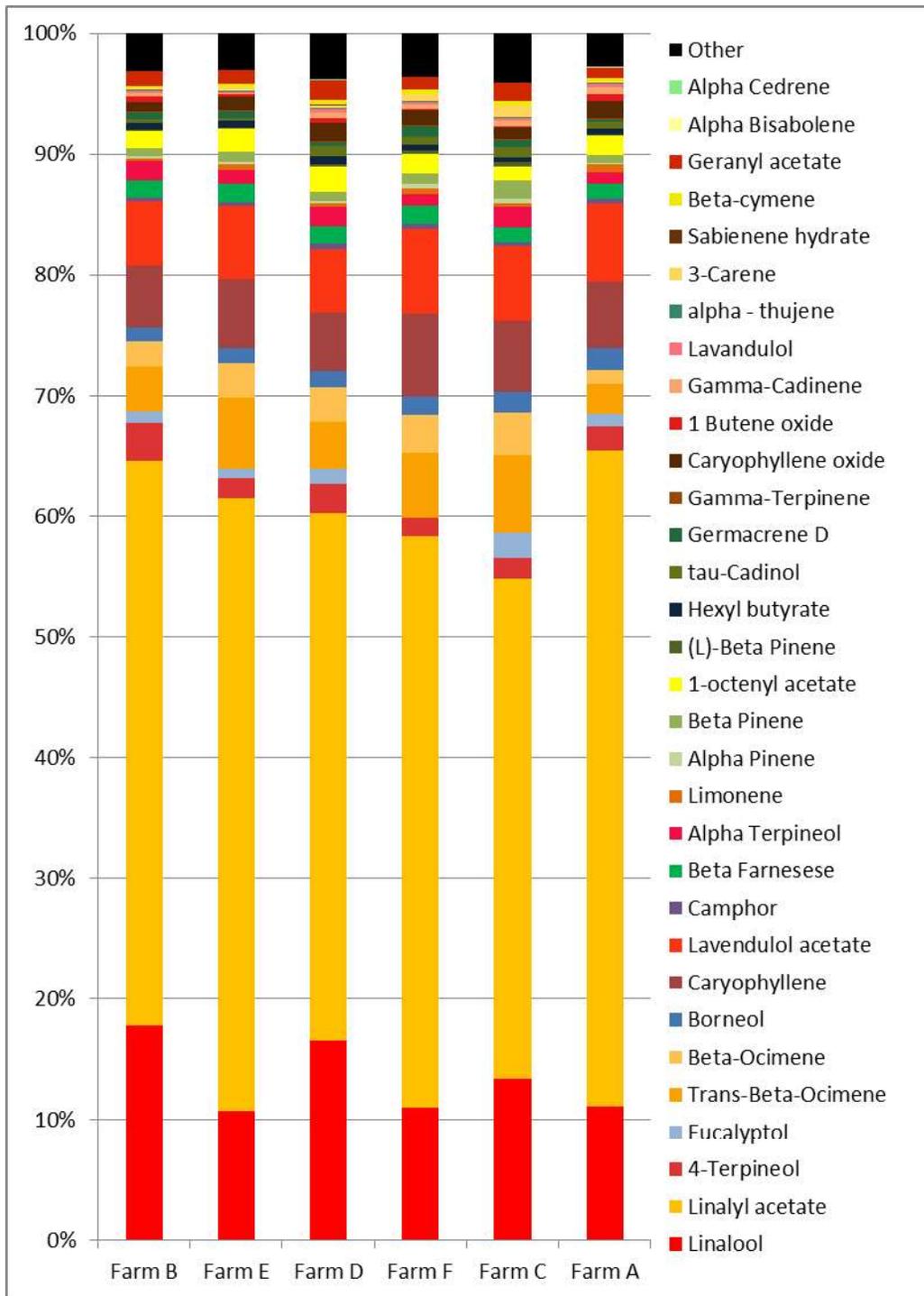


Figure 12. Essential oil profile of True Hidcote lavender from 2013, across four replications at six sites in southern Ontario. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

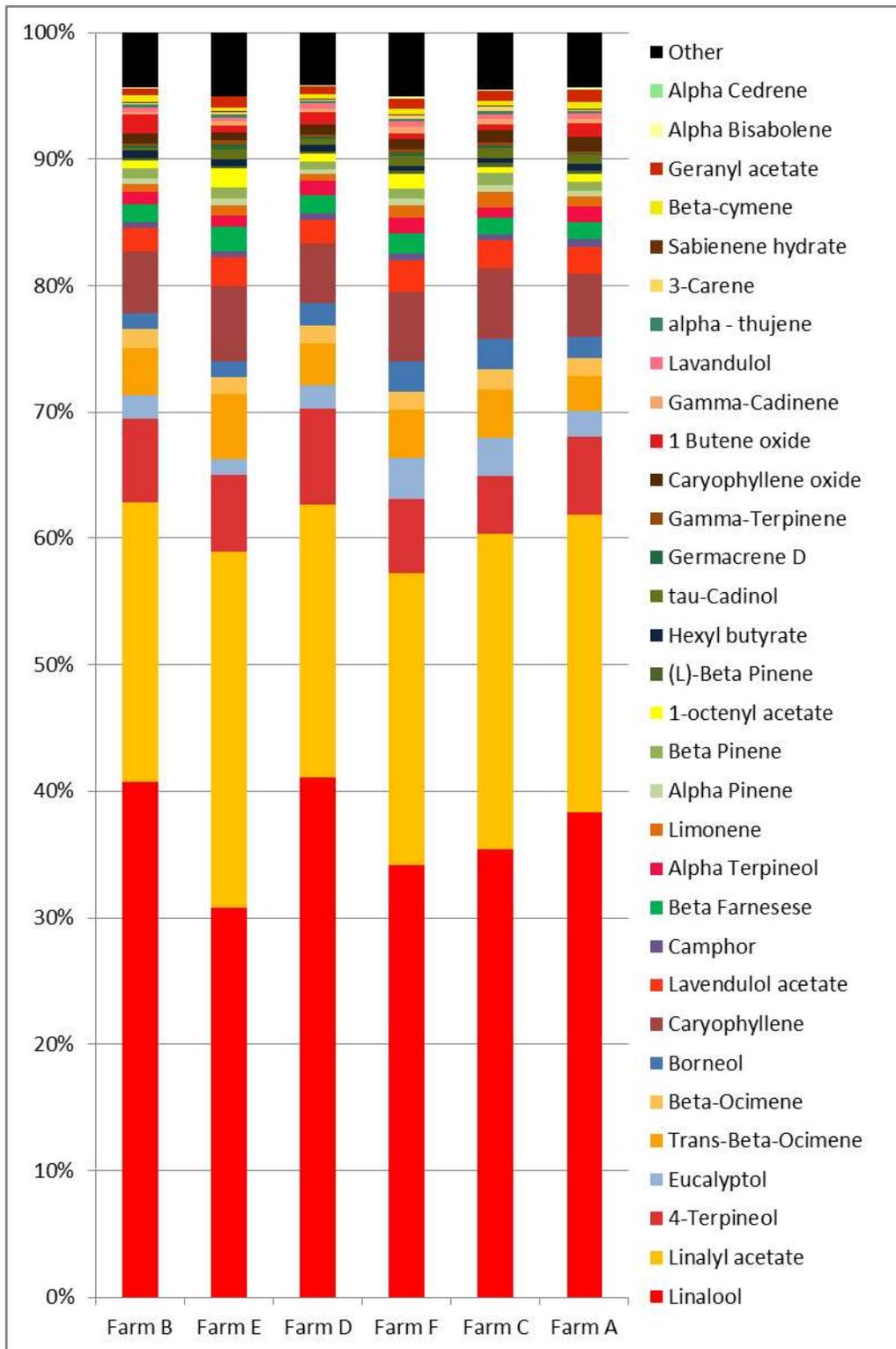


Figure 13. Essential oil profile of Royal Velvet lavender from 2013, across four replications at six sites in southern Ontario. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

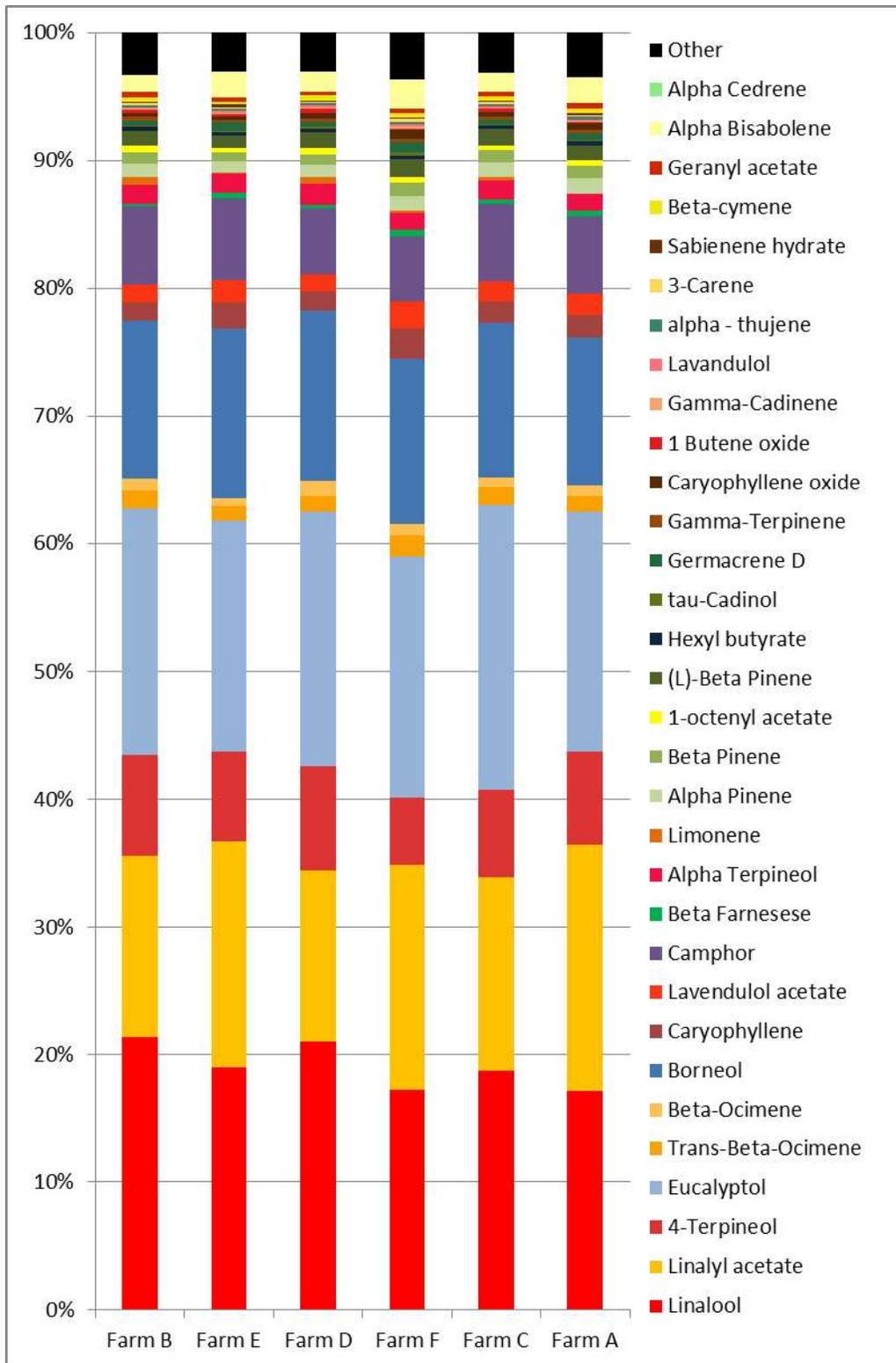
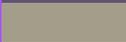
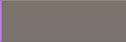
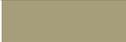
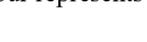


Figure 14. Essential oil profile of Edelweiss lavender from 2013, across one replication at six sites in southern Ontario. Colours represent the approximate odour type: reds = floral; yellow/orange = fruity; greens = herb, vegetative, woody; blues = camphor, pungent, medicinal; browns = spicy, pepper, cloves.

Table 25. List of cultivars in provincial cultivar trials with type, supplier, and fresh flower and dried bud colour in 2012/2013

Cultivar	Type	Supplier	Location	Flower Petal Colour	Dried Bud Colour ^z
Melissa	angustifolia	Lavender at Stonegate	Oregon		
Royal Purple	angustifolia	Lavender at Stonegate	Oregon		
Royal Velvet	angustifolia	Lavender at Stonegate	Oregon		
True Hidcote	angustifolia	Lavender at Stonegate	Oregon		
Hidcote Giant	lavandin	Lavender at Stonegate	Oregon		
Grosso	lavandin	Lavender at Stonegate	Oregon		
Provence Blue	angustifolia	Richter's Herbs	Ontario		
Betty's Blue	angustifolia	Lavender at Stonegate	Oregon		
Sachet	angustifolia	Supplier unknown	Washington		
Buena Vista	angustifolia	Lavender at Stonegate	Oregon		
Dark Supreme	angustifolia	Lavender at Stonegate	Oregon		
Folgate	angustifolia	Lavender at Stonegate	Oregon		
French Fields	angustifolia	Lavender at Stonegate	Oregon		
Imperial Gem	angustifolia	Lavender at Stonegate	Oregon		
Sharon Roberts	angustifolia	Supplier unknown	Washington		
Impress Purple	lavandin	Supplier unknown	Washington		
Premier	angustifolia	Lavender at Stonegate	Oregon		
Purple Bouquet	angustifolia	Lavender at Stonegate	Oregon		
Unknown	lavandin	Richter's Herbs	Ontario		
Maillette	angustifolia	Supplier unknown	Washington		
Edelweiss	lavandin	Lavender at Stonegate	Oregon		
Fat Spike	lavandin	Lavender at Stonegate	Oregon		
Grosso	lavandin	Lavender at Stonegate	Oregon		
Fred Boutin	lavandin	Richter's Herbs	Ontario		
Gros Bleu	lavandin	Lavender at Stonegate	Oregon		
Provence	lavandin	Lavender at Stonegate	Oregon		
Super	lavandin	Lavender at Stonegate	Oregon		
Tuscan Blue	lavandin	Lavender at Stonegate	Oregon		

^zCultivars showing split bud colours, left colour represents top of bud while right colour represents bottom colour of bud.