January 11, 2023, updated

Summary 2022 Splits Data

Methods

Three types of splits were made from single box 8-frame Comfort hives between May and August of 2022: Walk-away, 10-Day queen cells and 2-Day queen cells.   The queen cells were obtained from grafted eggs from over-wintered queen stock so that the exact ages were known. All splits were started with approximately the same population density of workers.

Approximately 3 weeks after the splits were made, they were inspected for split success and hive population density. Split success was determined by visual evidence of a queen and evidence of young brood. Absence of a live queen, failure of queen cells to hatch, the presence of a damaged queen (e.g., deformed wings) or evidence of laying workers, were considered failures. However, presence of a queen without eggs or young brood was considered evidence of a virgin queen and marked as a success.

Hive population density was assessed at inspection for split success and was categorized as low (2 or fewer frames), medium (3-4 frames) or high (5 or more frames).

Two generalized logit models (GENMOD) were run on split success and population density with type of split as the independent factor to determine the influence of type of split on success and population density, which can affect ability to perform subsequent splits. For modeling purposes, population density was coded to 1=low, 2=medium and 3=high. A 2-sided t-test was performed to compare each type of split to the others, if the model indicated that types of splits were an influential factor.

Results

A total of 292 splits were made between May and August of 2022. Of those, 96 were walk-away splits, 104 were splits using 10-day old queen cells and the remaining 92 were splits using 2-day old queen cells.

Type of split	N (%)
Walk-away	96 (32.9%)
10-day old queen cells	104 (35.6%)
2-day old queen cells	92 (31.5%)

Of the 292 splits, 187 (64%) were successful. With regards to population density, 44.5% of splits were categorized as having medium density (130 of 292) and the remainder were evenly divided between low density or high density (81/292; 27.7%, each). These outcomes were highly correlated (Spearman's rho=0.34, p<0.01) with the failed splits tending to be of low population density while the successful splits of higher population density. Below illustrates the number of hives by population density for failed

and successful splits, plus a cross tabulation of splits by population density and split success.
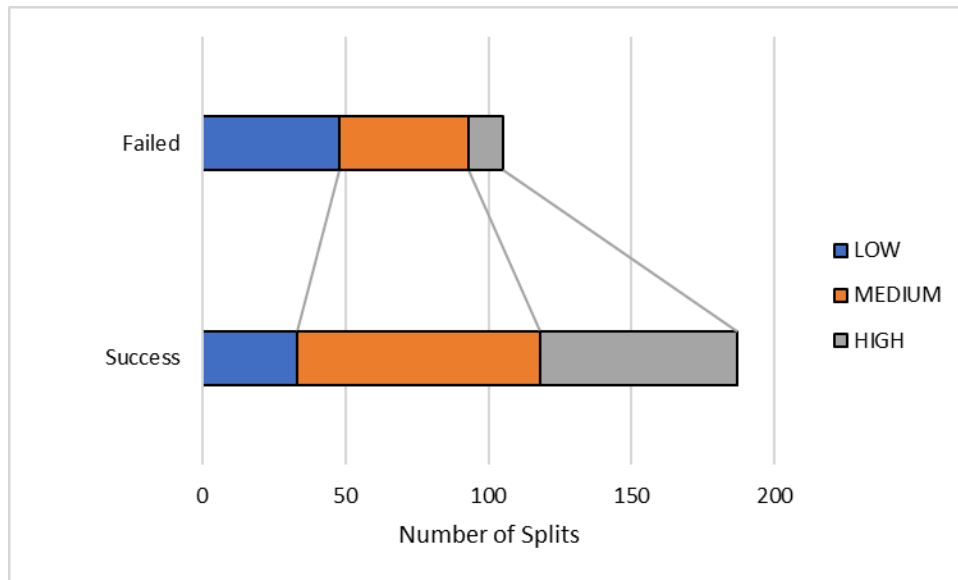
Population Density	Failed Split n(%)*	Successful Split n(%)*	Total N(%)
LOW	48 (59.3%)	33 (40.7%)	81 (27.7%)
MEDIUM	45 (34.6%)	85 (65.4%)	139 (44.5%)
HIGH	12 (14.8%)	69 (85.2%)	81 (27.7%)
Total	105 (36.0%)	187 (64.0%)	
*percentages are based on number of splits within each population density			

The type of split significantly affected success and population density. With regards to split success, there was no significant difference between 10-Day queen cell splits and 2-Day queen cells splits, although 2-Day queen cell splits had a slightly higher success rate than 10-Day queen cells (63% vs 56.7%). There was no significant difference between walk-away splits and 2-Day queen cell splits (72.9% vs 63%), but there was a significant difference between walk-away and 10-Day queen cell splits (72.9% vs 56.7%; p=0.048).

| | Type of Split | | |
	10-Day Queen Cells	2-Day Queen Cells	Walk-away
% Success	56.7%	63.0%	72.9%
vs 10-Day	--	NS	p=0.048
vs 2-Day	NS	--	NS
NS = not statistically significant (p>0.05)			

With regards to population density, walk-away splits yielded the highest overall population density and were significantly denser than 10-Day queen cell splits (p=0.028) or the 2-Day queen cell splits (p<0.001). There was no significant difference in population density between the 10-Day queen cell split and the 2-Day queen cell split, although the 2-Day queen cell splits tended to have the lowest overall population densities.

Density	Type of Split		
	10-Day Queen Cells	2-Day Queen Cells	Walk-away
Low (1)	33.3%	39.5%	27.2%
Medium (2)	42.3%	33.9%	23.9%
High (3)	27.2%	19.8%	53.1%
vs 10-Day	--	NS	p=0.028
vs 2-Day	NS	--	P<0.001
NS = not statistically significant (p>0.05)			

Caveat: Each type of split was performed at different parts of the summer, with walk-away splits occurring in late May, 10-Day queen cell splits occurring in late June and 2-Day queen cell splits occurring in late July. Since weather, food availability and other environmental factors can vary throughout the season, this introduces a potential bias in outcomes based on types of splits. Future studies should include all 3 types of splits equally throughout the season in effort to minimize temporal bias. For example, in May approximately of third of the splits should be walk-away, a third be 10-Day queen cells and the remainder 2-Day queen cells.

Conclusion

In this study walk-away splits were more likely to result in a successful queen-right hive and a denser hive population than splits made by introducing 10-Day or 2-Day queen cells. There was no significant difference in success rate or population density between the 10-Day and 2-Day queen cell splits.