Eva Crane Trust

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3. HONEY YIELDS PER ACRE OF LAND

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There is one aspect of honey production which perhaps deserves more attention than it is usually given. It is important, particularly in times of scarcity such as have recently occurred and threaten to occur again, that the food production from *any given area of land* should be as high as possible. Now honey is essentially an energy-producing food, and it is most useful to compare it with other foods from the energy standpoint, *i.e.* the number of calories it can produce. Table 1 (Marrack, 1943) gives an estimate of the calorific value of food obtained from 1 acre (0·4 hectare) of land put to various uses.

Table 1

Calorific value of foods produced from land put to various uses (Marrack, 1943)

	No. Cal./acre
Potatoes used for human food	4,000,000*
Carrots used for human food	3,000,000
Wheat used for human food	2,000,000*
Grass for feeding cows, whose milk is used for human food	650,000
Mangolds for feeding beef, used subsequently for human food	350,000
Grass for feeding beef, used subsequently for human food	200,000

* Results quoted by Yates and Boyd (1949) give 6,700,000 and 2,900,000 Cal./acre for potatoes and 'grain' respectively.

The calorific value of honey is somewhere about 1400 Cal./lb. (3100 Cal./kg.), but it is likely that some honeys differ from this figure by 100 Cal./lb. or even more.*

The honey harvest per acre of bee forage is subject to much greater variation, and its estimation is much more complicated. It involves two relationships, each of which is difficult to assess. Firstly we must know the *total* amount of honey which can be produced from 1 acre of bee forage. (The more usual practice is to estimate the amount of honey produced *per colony*, on the assumption that there is an excess of forage available; what we are interested in now is the yield *per acre*, when there are enough bees to collect all the nectar.) Secondly we need to know the relation between the amount of honey taken by the beekeeper and the total amount produced by the bees (or more correctly the total amount which would have been produced if the nectar collected had all been used for conversion into honey). Any sugar fed must of course also be taken into account.

Total honey yield per acre

Various workers have attempted to answer the first question; all emphasize the great variation in the honey yield which the bees can obtain from a given plant, according to the weather, the soil and the method of cultivation. Other workers, including some of those with the greatest knowledge of the subject, believe the difficulties in giving any useful estimate to be so great that they refuse to commit themselves. Table 2 gives the results arrived at by Père Dugat (1949) after 25 years' observation in E. France. His method (Dugat, 1950) was to use Dadant hives on scales, with ample stores in the brood chamber so that all nectar was placed in the supers; he corrected the weight increases during the nectar flow from the plant under investigation, by deducting the increase in weight on days when that plant was not secreting nectar and the bees were working others. Samples of foraging bees from 30 hives were taken three times a day, and the pollen content of their honey sacs examined in order to check the identity of the plants being worked. A few of the results given in Table 2, for plants not growing in quantity in eastern France, were taken from American, Russian, or other French sources.

Other estimates known to the author differ by a factor of not more than 2 (or occasionally 3), in either direction, from those in Table 2, most of which are probably roughly comparable among themselves. It seems likely that the yield of honey from most 'good' bee plants, secreting nectar under suitable conditions, can be of the order of 100 lb./acre (kg./hectare).

Total honey production and surplus honey production

We must now revert to the second relationship—that between *total* honey production and *surplus* honey production of a colony. The honey consumption of a colony of bees during the year has been variously estimated; for instance Root and Root (1940) conclude that in the southern States 200-250 lb. per year is required for colony maintenance, and in the northern States 200 lb. Pryce-Jones (1948) quotes a figure of 350 lb. The net honey *surplus* may vary from zero (or a negative quantity) to 100 or even 200 lb., or occasionally more. Table 3 gives the *surplus* honey produced as a fraction of the *total* honey produced for colonies A–P, each having a different combination of values for honey surplus and honey consumption. Except for colonies C, D and M, which would be unusual, the percentage is between about 10% and 50%.

* Calculated from the heats of combustion of glucose and other substances as given by Carpenter (1924). Milum (1949) says that 'honey often is assigned the rating of 1,481 Cal./lb.', but this value seems rather high, and unwarrantably precise.

TABLE 2

Approximate honey yields in one season from different nectar-producing plants (Dugat, 1949) [1 kg./hectare = 0·9 lb./acre]

Latin name	English name	Honey yield (kg./hectare) (approx. lb./acre)	Min. shade temp. for nectar secretion (°C)
Cruciferae			
Brassica napus v. *oleifera*	colza, rape	130	12
B. sinapis	mustard	190	12
Hippocastanaceae			
Aesculus carnea	red horse chestnut	120	10
Tiliaceae			
Tilia	lime	100	20
Leguminosae			
Acacia	acacia	150	17
Lotus corniculatus	bird's-foot trefoil	160	15
Medicago sativa	lucerne, alfalfa	210	16
Melilotus alba	sweet clover	150	16
Onobrychis sativa	sainfoin	200	15
Sophora	sophora	110	20
Trifolium repens	white clover	160	15
Rosaceae			
Malus pumila	apple	50	15
Prunus domestica	plum	30	10
P. cerasus	cherry	80	16
Umbelliferae			
Heracleum spondylium	hogweed	200	18
Araliaceae			
Hedera helix	ivy	230	10
Compositae			
Taraxacum officinale	dandelion	140	12
Solidago	golden rod	110	20
Ericaceae			
Calluna vulgaris	heather	140	15
Labiatae			
Lavandula	lavender	200	22
Rosemarinus officinale	rosemary	200	13
Satureia	savory	100	18
Thymus serpyllum	thyme	120	20
Polygonaceae			
Fagopyrum esculentum	buckwheat	60	12
Amentaceae			
Castanea	sweet chestnut	100	19
Hydrophyllaceae			
Phacelia tanacetifolia	phacelia	300	12
Coniferae (*honeydew, not nectar*)			
Picea excelsa	Norway spruce	400	27

Considering really good conditions—bee forage yielding 300 lb. honey per acre (see Table 2), and colonies yielding half their total honey production as surplus (I or N), the yield per acre available to the beekeeper would be 150 lb., *i.e.* 210,000 Cal., per acre. This is of the same order as the Calorie yield per acre (from beef) given in Table 1. The same bee forage, used by some of the less efficient colonies (A, B, G, H), would yield only 40,000-70,000 Cal./acre. There will also be a correspondingly smaller yield in Calories per acre from plants secreting nectar more slowly or for a shorter period, or from plants secreting nectar containing less sugar. For instance medium

colonies F and L working forage capable of yielding 50 lb. honey per acre would produce 14,000 Cal./acre – only 7% of the 210,000 Cal./acre estimated above.

TABLE 3

Surplus honey production as a percentage of *total* honey production (A, B, C . . . . P are 16 colonies taken as examples)

		Surplus honey produced by colony (lb.)			
		20	50	100	200
Honey consumed by colony (lb.)	100	A 17%	E 33%	I 50%	M 67%
	200	B 9%	F 20%	J 33%	N 50%
	300	C 6%	G 14%	K 25%	O 40%
	400	D 5%	H 11%	L 20%	P 33%

Discussion

It therefore seems likely that under the best conditions (of both bees and forage) the calorific yield from honey can be of the same order as that from meat fed on land of the same area, or about a tenth of that from wheat. (It must be remembered however that meat is important for its protein and fat content, while honey is not.) On the other hand if conditions are less favourable — inefficient colonies, poor bee forage, or poor conditions for nectar secretion or for foraging—the calorific value may be very considerably reduced. However while honey production cannot under many conditions compete on equal terms with the production of other foods from the point of view under discussion, it is not of *negligible* importance from this point of view.

It is interesting how closely the results calculated above are in accordance with the recommendations reached by Mr. F. C. Pellett on the basis of long experience (see pp. 9, 10): the introduction of good nectar plants into the agriculture of the neighbourhood (so that the land yields both beef *and* honey), and the devotion of areas which are unsuitable for any other agricultural purpose *entirely* to nectar production.

One other point to be borne in mind is the large foraging area required. An average English apiary of 5 colonies would require, say, 150 kg honey/colony for its own maintenance – even under the best conditions – the equivalent of some 10 acres covered with white clover within its foraging area. Under less good conditions, or with poorer forage, the nectar-producing area required might be 10 or even 100 times greater. The county of Middlesex, where there are 5 colonies to 100 acres, is generally held by beekeepers to be nearly 'saturated' with bees, so that if more colonies are introduced, it is to the detriment of those already present.

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