a small fraction of the coming demand. If, as has been urged, the exhaustless stores of the atmosphere are not available to plants, the outlook is dark enough; but if the farmer may use his crops to gather it, without money and without price, we may dismiss our solicitude. With the assurance that plants obtain nitrogen from the air, the fear of starvation for the over-populated earth of the future may be ignored. That research is bringing the brighter answer to this problem, there seems to be most excellent ground to hope.

## WARM AND COLD WATER FOR MILCH COWS IN WINTER.

WHETHER or not it is desirable in Wisconsin to warm water for domestic animals, has been experimented upon by F. H. King at the Agricultural Experiment Station at Madison.

On the night of Jan. 21, 1889, six cows were placed in stanchions side by side, in two groups of three each, upon a daily ration of five pounds of bran mixed with two pounds of ground oats and six pounds of hay, together with what dry cut corn-fodder they would eat up clean; and this ration was not changed until after the close of the experiment, March 25. During this time the cows were fed twice and watered once daily. They were allowed the freedom of the barnyard during the middle of each pleasant day, and in every way received similar treatment, except that, when one group of cows was getting water at 32° F., the other group took it at 70° F. The time of the experiment was divided into three periods of sixteen days each, having intervals between them. At the close of the first and second periods the temperatures of the water were reversed for each of the cows in order to eliminate, so far as might be, the individual differences of the two groups.

In plan this experiment contemplated as its chief object ascertaining whether it is true, as many farmers believe, that warm water for milch cows produces a measurable increase in the yield of milk over that of cold water, and, if so, whether this increase affected the volume simply, or the weight of the solids contained, to an extent which would make it remunerative in general practice to warm the water for cows.

The discussion of the results obtained has shown for these six cows, while under experiment, the following facts: —

1. While on warm water, they gave, on the average, 1.002 pounds of milk per cow per day more than while on cold water, or 6.23 per cent of the general average daily yield of 16.06 pounds.

2. They drank on the average, daily, while on cold water, 63 pounds; but while on warm, 73 pounds, or 10 pounds per cow more.

3. They ate more while on warm water than while on cold, and at the rate of .74 of a pound of corn-fodder per cow per day.

4. An increase in the amount of water drank was coincident with an increase in the quantity of milk given; and this was true irrespective of whether the water was warm or cold, an increase of 10 pounds in every 100 pounds of water drank being accompanied by an increase of 1 pound in every 100 pounds of milk given, nearly.

5. They consumed solid food, while on warm water, at the rate of 1.44 pounds for each pound of milk produced; and while on cold water, at the rate of 1.54 pounds for each pound of milk given.

6. An increase in the amount of water drank, when the temperature of the water remained the same, was associated with an increase in the amount of water in the milk without a notable increase in the total solids contained.

7. An increase in the temperature of the water drank, rather than an increase in the quantity of it, was associated with an increase in the total amount of solids produced.

8. There was a daily fluctuation in the percentage of water in the milk associated with a fluctuation in the amount of water drank.

9. Five cows manifested a strong preference for water at 70° over that of 32°, but one of the cows showed an even stronger liking for the iced water.

10. With but one exception, the cows, while they ate less and drank less during the cold-water periods, weighed more at their close, and, with but three exceptions, they weighed less at the close of the warm-water periods.

11. With butter at 20 cents per pound, skimmed milk at 25 cents per hundredweight, corn-fodder at $5 per ton, and the cost of warming water for forty cows 120 days at $15, the results obtained from the cows on the experiment indicate that a net gain of $21.36 would be realized on a herd of forty cows averaging sixteen pounds of milk per cow per day, and at least $10 on a herd of twenty, and $5 on a herd of ten cows. Counting corn-fodder at $10 per ton, the net gain on a herd of forty cows would still be $12.48.

## THE ETHNOLOGICAL SIGNIFICANCE OF THE BEECH.

THE new science of linguistic paleontology has thrown a flood of light on several obscure problems of ethnology. It has, for instance, been proved that the names of the ass and the camel in Aryan languages are not primitive, but merely loan-words from the Semitic. This fact by itself goes far to disprove the hypothesis which placed the cradle of the Aryans in Central Asia, a region of which these animals are natives.

According to an article on the above subject by Canon Isaac Taylor, published in a recent number of *Knowledge*, in no case have more valuable results been obtained than in the case of the beech. This tree, which flourishes only in temperate climates, and is a lover of chalk subsoils, is confined to a definite and restricted area. It grows in the extreme south of Norway and Sweden, but is not found east of a line which strikes across Europe from the Frische Haff on the Baltic coast, near Königsberg, through Poland to the Crimea, ending finally in the Caucasus.

In former times the limit was more narrowly restricted. In Cæsar's time the beech had not reached Britain or Holland, while at the close of the bronze age, or the beginning of the iron age, it was only just beginning to replace the oak in Denmark. Early in the neolithic age its range was probably confined to France, northern Italy, and northern Greece; while in Germany, as Dr. Schrader believes, it did not extend north of the Thuringian forest. It flourishes in Macedonia, and clothes the north-eastern slopes of the Thessalian coast chain, while in the south of Epirus the ilex or evergreen oak replaces it as the characteristic forest-tree.

Within these ancient limits of the beech we must place the cradle of four Aryan languages, — German, Latin, Celtic, and Greek. We draw this conclusion from the following philological facts: the word for beech is, in Gothoic, *boka;* in Latin, *fagus;* in Celtic, *faidhbhile;* while the corresponding word, φηγός, denotes the oak in Greek.

With regard to other members of the Aryan family, the names for the beech — *buky* in old Slavonic, *bukas* in Lithuanian, and *buk* in Russian — are manifestly loan-words from the German. This would go to prove that the Slavs, in the prehistoric period, must have dwelt east of the beech line, though they have since advanced within it. Johannes Schmidt has shown reason for believing in the unbroken geographical continuity of the European Aryans, previous to the linguistic separation: hence they must be placed astride, so to speak, of the beech line, — the Slavs and Lithuanians in European Russia; and the Celts, Latins, Hellenes, and Teutons, farther to the west.

We have now to account for the fact that the word denoting the beech in Latin, German, and Celtic, has come in Greek to denote, not the beech, but the oak. A well-known explanation of the difficulty has been offered by Professor Max Müller in the second series of his lectures. He contends that the word originally denoted the oak, but that it was transferred to the beech at the time when the oak-forests of Jutland were replaced by beech-forests. But this does not account for the fact that the Latin word *fagus* means the beech, for Helbig has shown that the Umbrians had already reached Italy before the commencement of the age of bronze. The bronze age began in Italy earlier than in Denmark, and in the bronze age the oak was still the prevailing tree in Denmark, and was quite unknown in the neolithic age, when the Umbrians, whose language was a dialect of Latin, were already settled in Italy. The word *fagus*, therefore, must have denoted the beech in Latin at a period prior to the change in the forest-growth to