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Melilotus indica on fall plant sugar cane

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BATON ROUGE, LOUISIANA

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CHEAP NITROGEN FOR SUGAR PLANTERS.

It has long been known that an ample supply of available nitrogen is most essential in the growth of sugar cane; also that the amount of that element that a crop of cane can use economically is governed largely by the supply of soil water. For a number of years past, the price of nitrogenous fertilizers has been high, and some nitrogenous substances which are in common use as fertilizers on the sugar plantation have reached such high prices, as compared with sugar, that they are prohibitive. Every factor in reducing cost, or in increasing efficiency is important. The water-holding capacity of any soil is governed largely by its state of tilth, and tilth in turn is influenced by the amount of humus embodied in the soil. In any system of crop rotation where legumes are plentifully grown, all of the nitrogen necessary to large crop production can be drawn from the air, and sufficient humus added to insure good tilth at a comparatively low cost. Our old method of rotating one year of corn and cow peas with two or three years of cane, left a large deficit in the soil nitrogen account. If good crops were grown throughout the entire length of time required during the rotation period, we would find that the cane required about 154 pounds of soil nitrogen for its growth; the corn required, for a 25-bushel yield, 34 pounds of nitrogen in grain, shuck and cob; and the cow pea crop would draw from the soil about 25 pounds. In addition to the 25 pounds taken by the crop of cow peas from the soil, about 50 pounds are drawn from the air, and this is returned to the soil when the entire cow pea crop is turned under. In other words, we have removed from the soil in growing crops 213 pounds of nitrogen and returned to it from the air 50 pounds, leaving 163 pounds as decreased nitrogen content of the soil. A small amount of the nitrogen was supplied in rain water, and possibly some came from the air, through the agency of microscopic life. If all of this 163 pounds was bought in the form of nitrate of soda, it would require 1100 pounds of that material and would cost at the present time about $37.75.

That much draft on the soil fertility of each acre distributed over a four-year period makes a very heavy tax, and is one that no farm can stand. With these facts before him, Director Dodson several years ago, instructed that we try to find a means of getting more legumes into our rotation, and suggested that we try to grow a clover cover crop on fall plant cane.

Crimson clover, Red Clover and Yellow sweet clover (*Melilotus indica*) were tried for this purpose.

Crimson clover grew well, but its habit of stooling so profusely injured the stand of cane, and while under very favorable conditions the growth of cane after crimson clover as a cover crop showed an increase in yield, the average of a number of years' work showed a loss.

Red clover does not stool so heavily, nor does it grow off as rapidly as crimson clover, except in the event of a very early spring season. In one instance of such a spring, an increase of 1.20 tons of cane due to red clover was secured; but an average of several years showed this crop to be of no value for such purpose.

Melilotus indica, called both yellow sweet clover and sour clover, known by many planters in this state as a weed and regarded as a pest, and until a few years back cursed along with "winter weed", proved of great value as a cheap nitogen gatherer. It adapts itself nicely as a leguminous catch crop without interfering with the usual rotation now in practice.

(In order to avoid confusion and save repetition this plant will be referred to throughout this bulletin as Melilotus or by its full botanical name *Melilotus indica.*)

Careful tests at the Sugar Experiment Station show that a crop of Melilotus planted on fall plant cane in October and turned under in the spring, will add to the soil from twenty thousand to twenty-seven thousand pounds of green matter, and that that green matter contains over one hundred pounds of nitrogen, equivalent to 667 pounds of nitrate of soda. This large amount of plant-food as has been estimated by various men who have tried it out costs from $1.25 to $3.00 per acre.

While the use of *Melilotus indica* in this way is new and novel to the sugar crop, it is by no means a new use for this

valuable nitrogen gatherer. One of the most striking examples of the benefits to be derived from it is shown by a California publication in which some carefully conducted experiments are reported, an abstract of which is as follows:

	Yield Corn Five-year Average Percent	Yield Hay Sorghum One-year Percent	Yield Sudan Hay One-year Percent
Non-legumes and 123 lbs. Nitrogen	20.8	54.3	21.3
Non-legumes and 41 lbs. Nitrogen	19.0	11.8	21.7
Melilotus indica	65.7	47.3	19.1
Non-legumes and 82 lbs. Nitrogen	33.4	31.9	24.9
Average of increase due to all winter cover crops was,*			37.7
Average of increase due to commercial nitrogen was,			29.6

One hundred and sixty-three pounds of nitrogen per acre gave as an average for a six-year period 51% increase, while the plots where *Melilotus indica* was used, gave an average increase of 57% without the addition of any nitrogenous fertilizer. (California bulletin 292.)

Experiments conducted at the Sugar Experiment Station for five years show that this crop can be depended upon by the sugar planters to do for them what it has done for the California investigators.

In the following table are given comparative yields of cane where Melilotus was used as a catch crop and 250 pounds of acid phosphate added, compared with check plots treated with 250 pounds of acid phosphate, but no nitrogen.

* Other winter cover legumes were included in this average.

FIELD DATA.

	Number of Stalks Per Acre				Tons of Cane Per Acre		Per Cent Sucrose in Juice	
	Spring Count		Fall Count					
	Clover Plot	Check Plot	Clover Plot	Check Plot	Clover Plot	Check Plot	Clover Plot	Check Plot
1917..	9493	9004	20464	13935	16.67	8.22	10.21	10.09
1919..	13933	8781	10308	9827	14.1	11.94	10.10	10.20
1920..	7101	7405	15913	15057	9.09	8.86	12.52	12.45
1921..	(3654)	(3871)	(9413)	(17028)	(8.04)	(12.67)	(12.5)	12.67
1922..	5635	5433	19413	16203	16.36	10.46	10.25	11.31
*Av..	9041	7656	16525	13711	14.06	9.87	10.77	11.01

. * 1921 not included.

Per cent increase due to Melilotus, 41.3.

In 1918 an effort was made to get a maximum growth of Melilotus, or in other words, the Melilotus was allowed to grow until very late spring, when it was in full bloom. By so doing the stand of cane was severely injured and the experiment was abandoned.

Figures for 1921 are not included in the average. Until that year home-grown, uncleaned seed had been used and always grew satisfactorily without inoculation. That year clean seed were bought and sown without inoculation, a good stand was secured, but only three rows next to a ditch and a border next a headland showed nodules. All the Melilotus where no nodules occurred turned yellow and probably a third of it died. These results are valuable and are reported here, for they may explain to some planters why they have not had success from the use of Melilotus. It is well to add that a great deal of Melilotus has been planted in the belt without inoculation, and that most of it has done well. The crops of this station of 1922 and 1923 were inoculated with fine soil taken from a field where Melilotus grew well the year before.

The nitrogen contained in Melilotus is in a form that becomes available just as a large sugar cane crop needs it. In fact in that respect this form of nitrogen seems to be ideal for the purpose. Experiments conducted at the Illinois station show that nitrogen from white sweet clover (*Melilotus alba*) becomes available steadily throughout four months. Figures given in

one of their bulletins are as follows: Analysis of soil April 26 for nitrate nitrogen before clover was turned under, showed 38.7 pounds. And after clover was turned under, as follows: May 30, 76.8 lbs.; July 1, 67.2 lbs.; July 14, 51.3 lbs; August 12, 143.61 lbs. Check soil, 10.1, 11.8, 18.6, 11.8 lbs. These figures show that practically all the nitrogen carried into the soil by the clover crop had undergone nitrification and had become available as plant-food in 108 days. In Louisiana where the warm weather opens up earlier than it does in Illinois, the chances are that nitrification would take place faster than it did in Illinois. At any rate, the analysis of the cane grown here shows that the large quantity of nitrogen is made available early enough to insure against the possibility of unduly green cane for the mill.

A large number of sugar planters have already given attention to this valuable crop, and a brief statement from a few of them may prove of benefit to others. The first planter to take up this crop was Clark D. Liebermuth, Salsburg Refining Co., who reports:

> "Increased yield due to sweet clover (Melilotus); estimated two to five tons in plant cane. No other fertilizer applied with clover. No effect on stand of cane, provided clover is turned under early as is winter grass. No tonnage measured on stubble crop, but better tilth of soil noted during two years. Increase in cost of cultivation negligible. Seed used 25 pounds per acre. Clover (Melilotus) removed by Magnolia cane scraper."

Walter Godchaux, reporting for Raceland, says:

> "Increased yield due to sweet clover (Melilotus) 22%. On twenty-five ton yield five and one-half tons. No fertilizer applied with clover (Melilotus). No injurious effect to stand except in one instance, on Utopia, during extremely dry year, decreased stand of 25% noted. In all other instances where clover (Melilotus) was used during the past few years, we have noticed no difference in stand. Average cost per acre, including cost of seed and extra labor, $1.50 per

> acre. Do not think cost of cultiviation is increased or decreased materially. Sour clover (Melilotus) is scraped off with plant cane scraper."

Mr. Godchaux reports one instance where a loss of 1.5 tons per acre at Raceland was shown, but explains that the section in this experiment was near the sugar house and had been treated with filterterpress mud and manure compost, and that it was possible that non-clover section received more manure than did clover section. And, too, it is a well-known fact that Melilotus will not draw nitrogen from the air in any appreciable quantities if planted on soil extremely rich in nitrogen.

Stanley F. Morse, in 1921, reported increased yields due to Melilotus, at another one of the Godchaux places, of six tons, or 30%. He also showed 7.5% increase at the Colonial Sugar Company.

Andrew H. Gay reports that he has planted Melilotus one year and got a wonderful stand, at a cost of one dollar for seed and twenty-five cents for sowing. Has, as yet, no estimate on yields.

> Judge Gilbert reports: "Have used clover (Melilotus) for two years and find it of some help in keeping down grass and of benefit to the soil. Have no special data on difference in tonnage."

> J. T. Guyton: "Used clover (Melilotus) last fall at rate of 20 pounds seed at 6-cents a pound. Clover (Melilotus) taken off and turned under in usual way that we handle fall cane when we do not use it, for we always have a crop of winter grass to be scraped off and turned under. The only cost is for seed, and small cost for sowing. As far as effect on stand is concerned, we find there is no difference. In breaking out middles of the land that has had clover (Melilotus), we find that the land is in better condition than land that has had none."

> J. W. Supple: "Never determined yields of cane with or without clover (Melilotus) crop. Planted small way in 1921; large way in 1922. Never used commercial fertilizer with clover

> (Melilotus), nor did it affect stand. Cost of planting very small, as one man will sow 12-15 acres a day by hand. We sow 18-20 pounds per acre. No extra cost to turn under, as we scrape rows in usual way with Avery cane scraper, wrap middles and off-bar cane and clover completely. No increase in cultivation costs."

Lewis Murrell, who has tried out Melilotus on quite a scale with a two-ton cane increase, when talking about the use of Melilotus, says: "Personally I believe that in three or four years all our old lands will become new lands again."

O. C. Roemer, County Agent for Iberville parish, conducted a series of tests with Melilotus on fall plant cane. The average increase of eight tests made by him was 5.3 tons, and the minimum was 3.1 tons. He has placed orders for 150,000 pounds to be used in his territory the coming fall.

HOW TO USE MELILOTUS.

Melilotus seed, at the rate of twenty to twenty-five pounds, should be sown broadcast over the cane lands after the rows have been built up. The seed can be covered by the ordinary roller, though the cultipacker insures a better job. Melilotus seed should not be sown on extremely cloddy or rough land, for in such a case the chance of losing seed due to poor covering is great.

In case Melilotus has not been grown with success on a soil, it is a good practice to inoculate either the soil or the seed. This can be done satisfactorily and with the least cost by using top soil from an old field of Melilotus or alfalfa where it is known that the soil was inoculated, or in other words, where the crop grown the year before produced nodules and grew well. Soil from such a field should be taken from the first six inches and dried IN THE SHADE until it will crumble nicely. Sift this soil, if necessary, and sow over the land at rate of 200 pounds per acre just before covering or rolling. It will be easier and probably cheaper to moisten the seed with a sticky molasses solution made of one gallon molasses and five to ten gallons of water. This solution should be just sticky enough to

be felt between the fingers. After moistening the seed sprinkle into them the dried and pulverized soil, then allow them to dry *in the shade* before sowing.

WHEN TO TURN UNDER CLOVER.

Melilotus should be allowed to make as much growth as possible without taking the chance of injuring the stand of cane, or jeopardizing the progress of field work. On large-scale planting, the planter cannot afford to wait too long before scraping, but he should realize that the longer he lets his Melilotus grow the more nitrogen and organic matter will accumulate. An ideal time for turning under Melilotus is during the early blooming period. At that time the plant has reached a high degree of maturity and is rich in nitrogen. If it will not jeopardize the general plan of work, it would be profitable to hold the Melilotus until some small injury is done to the stand of cane, for tests at this station show that cane after Melilotus was turned under on March 22, though beginning with a poorer stand, produced more canes by harvest and a greater yield per acre than did cane after clover turned under twenty days earlier.

CANE AFTER MELILOTUS IN 1922.

Date Turned Under	Spring Stand		Fall Stand		Tons Per Acre	
	Clover	Check	Clover	Check	Clover	Check
March 2	6190	5453	18951	16203	14.08	10.46
March 22	5635	5433	19413	16203	16.36	10.46

It is important to know that under certain conditions nitrogen may escape from the soil as a gas. This is due to certain denitrifying organisms, and it is claimed that large losses of nitrogen are likely to occur when heavy crops are turned under in a poorly drained soil. For this reason it is not advised that Melilotus be used on soils that, from lack of drainage, are likely to become water-logged.

If we are to get the best results from our labor, our soils should not be allowed to become lacking in any one of the essential elements. Next to nitrogen, sugar cane in Louisiana needs phosphoric acid. Melilotus will build up the nitrogen ac-

count and it will bring up some phosphoric acid from the subsoil, but it cannot add phosphoric acid. Any soil that is entirely lacking in any one of the essential elements will not produce; and a soil that is poor in any one of the essential elements, even though it is rich in all of the other elements, will not grow maximum crops. Plant cane draws more phosphoric acid from the soil than does any of the other crops in our rotation, and we should take care of that account by adding about two hundred pounds per acre of high grade acid phosphate to our plant cane after Melilotus cover crops.