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Activities of the Division

During the period under review, about 110,000 units (1000 m^2 each) of inoculants were prepared for peanuts, alfalfa (*Medicago sativa*) and burr medic (*M. polymorpha*) and supplied to farmers in various regions of the country.

Studies were aimed at increasing the content of peanut bacteria in peat inoculants by using more suitable peat. An effort was made to isolate and define the inhibiting factors of bacterial growth in the local peats.

The desirable combination of bacterial strains used for inoculant production was determined.

A study of serological characteristics of peanut bacterial strains was carried out. The results may be useful in determining the competitive ability of various strains in the inoculants as well as in the soil.

Work was done on selecting and on testing the efficiency of peanut bacterial strains for inoculant production.

In calcareous soils of the Bet She'an area, difficulties were encountered in successful peanut inoculation and in obtaining satisfactory yields. Therefore, an investigation was conducted on the effect of higher rates of inoculants and adequate fertilization.

The dynamics of nitrogen fixation of inoculated beans (Phaseolus vulgaris) was studied under greenhouse conditions, in order to determine the most active and critical period of nitrogen fixation. Restricting the time of testing the various bacterial strains to such a critical period will lead to savings in work and greenhouse areas, in addition to greater accuracy and standardization in evaluating the bacterial effectivity.

Seasonal changes in nitrogen, phosphorus and potassium contents in the tops of inoculated beans were followed under field conditions, in order to determine the desirable nutritional status enabling higher yields of green pods for canning.

Following the study of native chick-peas (Cicer arietinum) rhizobia in the northern Negev, an examination of these bacteria was carried out in the northern part of the country. Field trials of chick-peas inoculation were performed.

Symbiotic properties of the bacterial population specific for common vetch (Vicia sativa) in the soils of southern Israel were studied. Following the trials done in the south, a study of local specific bacterial population in the main northern centers of alfalfa (M. sativa) was initiated.

In order to further the production of protein-rich forage in dryland pasture, studies of burr medic (Medicago polymorpha) in southern Israel were carried out. Field trials were conducted to investigate the most effective mode of burr medic inoculation with different rates of phosphorus fertilizer.

RESEARCH SUMMARIES

Effect of various peats on peanut rhizobia proliferation

Rina Löbel and J. Schiffmann

One of the most important factors in inoculant production is the quality of the medium in which the bacteria are grown. Since this medium consists mainly of peat, great importance should be attached to its quality. Some peats may have a negative effect on the proliferation of symbiotic bacteria.

Bacterial growth was studied in peat samples, all of which were taken from the drained Hula region. All samples were relatively rich (>50%) in organic matter content. The conditions for bacterial growth - pH, moisture, etc. - were similar in all cases. At the end of the incubation period the most probable number of bacteria per one gram of peat was determined. The following results were recorded: Peat no. 1, 10.2×10^6 bacterial cells; no. 8, 58.0×10^6; no. 3, 173.4×10^6; and no. 5, 590.0×10^6 bacterial cells.

Additional results indicated that excessive accumulation of NH_4-N and NO_3-N in the peat may greatly inhibit bacterial growth.

Storage conditions preventing excessive accumulation of available nitrogen were investigated.

Increasing the peanut rhizobia content in the peat carrier

J. Schiffmann and Rina Löbel

It is difficult to produce inoculants for peanuts with high bacterial content, because of the relatively scanty proliferation of the slow-growing specific strains in peats. Suitable peats together with adequate nutrients may enable better proliferation of the bacteria. In addition, a reduction in the inhibitory effect of peat carrier on peanut rhizobia was achieved by combining (in liquid inoculum used for peat inoculation) the specific rhizobia with non-specific and non-infective fast-growing and slime-producing bacteria isolated from peanuts. Peanut symbiotic bacteria had been grown in liquid culture 8-10 days before the fast-growing isolates were added.

Several examples of positive effects of mixed liquid inoculum on peanut inoculants are given below. The most probable number of the specific peanut rhizobia was determined by the plant infection method.

No. of peanut bacteria/1 g peat carrier	With peanut strains only	With mixed inoculum of specific strains and fast-growing isolates
Peat carrier A	0.473×10^6	1526×10^6
Peat carrier B	0.567×10^6	2037×10^6
Peat carrier C	5.9×10^6	1830×10^6
Peat carrier D	59.0×10^6	3365×10^6

A study of the serological properties of rhizobia specific for peanuts

B. Kishinevsky and Rina Löbel

Rhizobial strains are characterized by their antigenic heterogeneity. Thus, it is common to use serological tests for the identification of these bacteria. The peat inoculant produced in Israel, in the Division of Legume Inoculation, contains a mixture of several efficient rhizobial strains. It is therefore important to enable a rapid and reliable identification of the strains in the inoculant as well as in the field. Serological typing may provide information to what extent the applied strains have become field naturalized.

Eleven strains were chosen from the Division's collection. The determination of the serological properties of the bacteria was based on the antigen-antibody reaction. These tests were performed by the aggulutination and immunodiffusion techniques. Performance of these mentioned techniques required the preparation of antigen and antiserum. Antisera were prepared by intravenous injections of antigen to rabbits and bleeding them in the usual way.

Agglutination. Five antisera were checked with homologous titer ranging from 2560 to 5120*. It was apparent that

*The values represent the highest serum dilutions which gave positive results.

all the antigens reacted to all the tested antisera. The differences in the agglutination titer indicate that among the tested strains, some are similar - but not identical - in their antigenic properties. The findings indicated that the agglutination technique enables us to distinguish between strains with different antigenic properties.

Gel-immuno-diffusion technique. Five peanut rhizobial strains were used as antigens. Precipitin lines were performed only after the bacteria had been killed. Under these conditions precipitin lines appeared between the well containing the antigen and that containing the antiserum. The number and shape of lines indicated visual differences for the homological and heterological reactions among the tested strains. The results obtained with the gel-immuno-diffusion technique indicated the heterogeneity of the tested strains but also can give more information than the agglutination method alone.

A survey of native rhizobia specific for peanuts in the light soils of the coastal zone

B. Kishinevsky

In order to determine the existence and distribution of the naturally occurring bacteria specific for peanuts, a comprehensive survey was conducted in the non-inoculated light soils of the coastal zone. For this purpose 44 soil samples were aseptically taken from various sites in the region extending from Rehovot in the south, to Pardess Hanna in the north. The present survey included 23 samples from citrus groves, eleven from eucalyptus woods, and ten from uncultivated fields where to the best of our knowledge peanuts had never been grown. The soil samples were transferred into growth containers in which peanuts of the cultivar "Shulamit" were grown for two months, under aseptic conditions. Autoclaved soil was used as control. The following analyses of the soil were carried out: texture, pH, and the contents of limestone, organic matter, total nitrogen, available phosphorus and potassium. During the period of growth, nodulation was scored. It is interesting to note that the test plants nodulated only in 20 of the 44 soil samples. Nodules were formed in nine samples taken from citrus groves, nine from woods, and two from uncultivated fields. It should be noted that in most of the cases, even where nodules were formed, yellowing of the foliage, small area of the leaves, nodulation of secondary roots only, and lack of haemoglobin in the nodules, were observed. In view of these facts it is evident that the rhizobia occurring in these soils are ineffective. Nodule bacteria were isolated from all the treatments in which nodulated plants were found. In all, 305 nodules were sampled for isolations. All the bacteria isolated were tested under bacteriologically aseptic conditions for their specificity to peanuts. The test plant was *Phaseolus lathyroides*.

Determination of the antigenic properties of native rhizobia as a means of classifying them into different serological groups

B. Kishinevsky

Ineffective strains sometimes dominate the rhizobial population. Under such conditions, it is important to introduce into the soil by means of inoculation an adequate amount of effective rhizobial strains capable of surviving and competing successfully with the native rhizobial population for the colonization on root sites and nodulation. In order to achieve this aim, it was necessary to prove the antigenic heterogeneity of the native peanut-specific rhizobium under various soil conditions in Israel. The aim of the present investigation has been to obtain information on the antigenic properties of these bacteria. A survey was conducted of many soil samples collected in the coastal zone. So far, 170 rhizobial strains were isolated and used as antigens. Some of the strains chosen for the preparation of antisera were similar in their serological reaction, while the others differed in this respect. The agglutination technique was used for testing the strains with ten antisera.

As indicated by the results, the studied rhizobial strains contain various somatic antigens. The antigenous structure of the respective strains is a result of one or a number of somatic antigens, which may appear in different combinations.

Effectiveness of rhizobial strains of various serological groups

B. Kishinevsky and Rina Löbel

An experiment was carried out in growth containers, under bacteriologically controlled conditions, to study the effect of various rhizobial strains on the development of peanut plants. The experiment included 14 treatments: Control - neither inoculated nor N-fertilized, plants fertilized with KNO_3, and 12 treatments inoculated with rhizobial strains representing four different serological groups. Phosphorus and potassium were applied in equal rates to all treatments including the control. All growth containers were sown with peanuts cv. 'Shulamit'. Plant development was scored during the growth period, which lasted for two months. Visual observation indicated conspicuous differences between the control and the inoculated treatments. Plants inoculated with various strains differed visually. This indicated the diversity in the effectiveness of the strains used.

Dry matter and protein content were determined, and an acetylene-ethylene reduction assay for N_2 fixation was performed. From the results obtained, the following can be concluded: a) The data on dry matter and on total nitrogen confirm the existence of significant differences among the various tested strains. Plant nitrogen content and plant appearance corresponded positively. b) The symbiotic effectiveness of strains was unrelated to serogroup. Strains belonging to the same serological group were of different effectivity, while others - belonging to different serological groups - did not differ from one another in their activity. c) Most treatments showed a positive correlation between nitrogen content in tops and the rate of ethylene production as measured by the acetylene-ethylene reduction assay.

Evaluation of the competitive ability of peanut rhizobia according to their antigenic properties

B. Kishinevsky

A strong and permanent competition among the various rhizobial strains for nodulation sites is known. A prior requirement for the determination of bacterial competitiveness is a reliable strain identification. Three rhizobial strains from two different sources were chosen for experiments: one used in commercial inoculants in Israel, and two other strains isolated from the natural soil population. In order to determine the differences in antigenic properties between the strains, they were examined by the agglutination test.

After the strains had been identified a study was conducted for the determination of their competitive capacity. An experiment was carried out in aseptic assemblies of the Leonard type under controlled conditions. Peanuts of the cv. 'Shulamit' were used as the host plants. Sandy nitrogen-poor soil on which peanuts are usually grown was used as a substrate in the growth containers. For inoculation the strains were mixed together in all possible pair combinations in ratios of 1:1, 1:10 and 10:1; about 10^9 viable rhizobia, single or mixed, were added. When nodules appeared they were sampled to identify the bacteria they contained. Five samples of nodules were tested throughout the growth period. Although not all of the results are final, it appears that one of the three tested strains outstripped the others in the number of root nodules formed. It should be noted that the strain used for inoculant production was the most competitive.

Symbiotic efficiency of nitrogen-fixing bacteria specific for peanuts

Rina Löbel and J. Schiffmann

Within the period 1974-1977, 62 various rhizobial strains were tested on peanuts for their symbiotic effectivity in three different pot trials carried out in nitrogen-poor soil, under bacteriologically controlled conditions. Each treatment was tested in six replicates, and compared with non-inoculated control and N-fertilized plants (KNO_3). From the best strains in each trial, the rhizobia most suitable for the preparation of inoculants were chosen.

Trial A

Trial period: June 6 to August 6, 1974. N-uptake by control plants, 100%; plants fertilized with KNO_3, 185%; inoculated plants, 352-423%. Best strains: $283A_{23}$, 284A, 5a/70, 286A, $283A_{56}$, $R/283A_{20}$, 38b/70.

Trial B

Trial period: June 26 to September 1, 1975. N-uptake by control plants, 100%; plants fertilized with KNO_3, 189%; inoculated plants, 418-570%. Best strains: $R/283A_{20}$, 5a/70, $R/284A_5$, $R/283A_{19}$, $R/283A_{18}$, $R/283A_1$.

Trial C

Trial period: June 2 to August 2, 1976. N-uptake by control plants, 100%; plants fertilized with KNO_3, 219%; inoculated plants, 505-640%. Best strains: $R/280A_9$, $R/283A_{19}$, 280A, $R/283A_{18}$, 59b/70, $R/283A_{20}$, $R/283A_1$.

Peanut inoculation with various inoculant rates at different levels of fertilization in calcareous soils*

Rina Löbel and J. Schiffmann

The results of inoculation pot trials with various soils from the Bet She'an area showed that satisfactory nodulation in very calcareous soils can be achieved by application of the usual amount of rhizobia. Failures of inoculation in those soils were probably connected with inadequate plant nutrition.

Balanced application of phosphorus and potassium fertilizers considerably increased the efficacy of inoculation and the total nitrogen content in peanut plants.

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Nitrogen assimilation dynamics in inoculated snap-beans under greenhouse conditions

Rina Löbel and J. Schiffmann

The nitrogen content in the leaves of bean plants inoculated with various rhizobial strains was found to range from 4.72% (24 days after sowing) to 2.00% (73 days after sowing). The critical period for checking the nitrogen content in leaves (*i.e.*, that period beyond which the nitrogen content declined consistently due to plant age) occurred between 39 and 45 days after sowing. The nitrogen content at that time ranged between 3.7% and 3.9%.

The highest rate of nitrogen fixation (measured by the acetylene-ethylene reduction technique, in µmoles C_2H_4/h/plant) occurred 39 days after sowing, with 1.68 - 1.43 µmoles C_2H_4 per container (four bean plants).

The highest values of the nitrogen fixation intensity (µmoles C_2H_4/h/g dry wt nodules) occurred 31 days after sowing, and ranged from 20.7 to 28.4 moles C_2H_4. However, at 39 days after sowing the intensity of nitrogen fixation was still appreciable.

The best correlation (r=0.75) was obtained with nitrogen content (%) in leaves and the fixation intensity but not with the rate of nitrogen fixation. The values of the rate of nitrogen fixation as well as of fixation intensity recorded for bean plants under greenhouse conditions were much lower than those recorded under field conditions.

The results of the present experiment show that it is possible to confine the testing period of snap-bean bacterial strains under greenhouse conditions to 45 days after sowing, or even less, according to the parameters chosen.

Comparative tests for effectivity of bean-specific rhizobia

Rina Löbel and J. Schiffmann

Twenty-three isolates of bean rhizobia were tested on cv. 'Tenderette' under greenhouse conditions in two separate trials. The observations were carried out at 50-53 days after sowing. The average results (of six replicates) given herein refer to four plants per container.

Foliage (leaves and stems) dry weight with the most effective strains (2a 1/71, 3a 1/71, 5a/73, 2b/73) ranged from 6.64 to 6.19 g, *versus* 4.13 - 3.45 g in control non-inoculated plants.

Nitrogen content in leaves of plants inoculated with the most effective isolates ranged from 3.78 to 3.26%, *vs.* 2.59 to 2.10% in control plants. The amount of total nitrogen in leaves with the most effective strains ranged from 129 to 112 mg *vs.* 55 to 36 mg in control plants.

Pod dry weight with the most effective strains ranged from 3.84 to 2.69 g, compared with 1.48 to 0.87 g in control plants.

The acetylene-ethylene reduction assay gave 1.817 to 0.925 µmoles C_2H_4/h/container (four plants) and 3.207 to 1.55 µmoles C_2H_4/h/g dry wt. nodules. There was no correlation between the rate of nitrogenase activity and the other parameters used, probably because of the timing (at harvest) of the acetylene-ethylene assay.

The number of root nodules (for four plants) ranged from 1161 to 1157, and the weight of root nodules from 573 to 410 mg.

Seasonal changes in the chemical composition of inoculated snap beans in sandy soil

J. Schiffmann and Rina Löbel

Nitrogen, phosphorus and potassium contents in beans (*Phaseolus vulgaris* cv. 'Tenderette') inoculated with Rhizobium and grown in a nitrogen-poor soil were determined in a field trial at various stages of plant growth. The aim was to provide a basis for estimation of the nutritional status corresponding with high yields of green pods for canning.

Beans were inoculated at planting time with two kinds of rhizobial strains separately, one producing an acid reaction on the usual agar medium and the other an alkaline one. The differences between yields and chemical composition of plants inoculated with two kinds of strains were statistically nonsignificant. Average yields of green pods for canning picked in a single harvest 59 days after sowing were 2280 kg and 2556 kg/1000m^2, respectively. Dry weight of hay (excluding pods) at harvest time reached an average of 438 kg and 403 kg/1000m^2.

The above yields corresponded with the following average nitrogen, phosphorus and potassium contents in leaves and stems at the beginning of the testing period (23 days after sowing) and close to the harvest time (57 days after sowing):

The N-content in leaves at the beginning of the period was 3.8 - 3.79% and close to harvest 3.00 - 2.96%; in stems, 2.12 - 2.02% and 1.05 - 1.03%, respectively.

The P-content in leaves was 0.395 - 0.273% at the beginning and 0.304 - 0.299% at harvest time; in stems, it was 0.307 - 0.298% and 0.291 - 0.269%, respectively.

The K-content in leaves was 3.28 - 2.60% at the beginning and 2.23 - 1.84% at harvest time; in stems, it was 7.93 - 6.59% and 4.75 - 4.44%, respectively.

The N, P and K content ranges in pods (on a dry matter basis) at the end of the period were, respectively, 2.11 - 2.06%, 0.344 - 0.330%, and 3.16 - 3.15%.

The total N in foliage (including the leaves, stems and pods) ranged from 13.85 - 13.31 kg/1000m^2; total P in foliage was 2.21 - 2.03 kg/1000m^2; and total K was 23.81 - 22.69 kg/1000m^2.

Effect of nitrogen fertilizer application on inoculated beans growing in light soil

J. Schiffmann and Rina Löbel

A comparison was made between beans (*Phaseolus vulgaris* cv. 'Tenderette') inoculated with various rhizobial strains, and those fertilized with different rates of nitrogen fertilizer (ammonium sulfate) in addition to inoculation with the same strains.

The results showed that both the high rates of ammonium sulfate (90 kg/1000m^2 in one basic application or in three split applications) and the low rates of this fertilizer (30 kg/1000m^2 in one basic application, or 60 kg in two split applications) had a negative effect on bean nodulation. The 90 kg/1000m^2 of nitrogen fertilizer applied before sowing resulted in a considerable recovery in the rate of nodulation 57 days after sowing; however, this is very late considering the short period of bean growth and it therefore had no significant effect on the yield of green pods for canning.

The amount of N_2 fixed by inoculated bean plants (as measured by the rate of acetylene reduction per hour per plant) corresponded in general to the rate of nodulation in the various treatments.

The intensity of N_2 fixation (as measured by C_2H_2 reduction/h/g dry wt. of nodules) at the beginning of the growth period was lower in N-fertilized plants than in those not fertilized with N. Later in the season, the activity of nitrogenase increased considerably in all fertilized treatments, presumably due to depletion of mineral nitrogen in the soil and the concomitant increase in nitrogen demand of the developing plants. This belated increase in the symbiotic intensity was an important compensatory factor in increasing also the amount of atmospheric nitrogen recovery per plant. The amount of total nitrogen assimilated by the inoculated but non-N-fertilized plants (including leaves, stems and green pods) averaged 13.58 kg/1000m^2 at harvest. The amount of total N assimilated by inoculated and N-fertilized plants ranged from 13.40 to 15.67 kg N/1000m^2, according to various rates of N-fertilization. There was no statistical difference between the amounts mentioned above.

The yield of green pods (for canning) obtained in a single harvest averaged 2418 kg/1000m^2 for inoculated but non-N-fertilized beans. The yield of pods of inoculated and N-fertilized beans ranged in various nitrogen treatments from 2325 kg (with 30 kg of N-fertilizer) to 2619 kg of green pods (with 60 kg of N-fertilizer in two applications). There was no statistical difference between these green pod yields and likewise none between their dry weights.

There was a tendency toward a slight increase in seed yield (5 - 12%) due to nitrogen fertilization, but this increase was statistically non-significant.

Chickpea inoculation trials in the Jenin area

Rina Löbel, J. Schiffmann, Z. Ben-Herut* and Ahmed Muhsan**

The results of field and aseptic greenhouse trials showed that the soil in the area contains a small but effective native population of specific rhizobia which, be-

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cause of their scarcity, were able to induce only relatively scanty nodulation in fields cropped for the first time with chickpeas. Inoculated plants with effective rhizobia bore considerably more nodules (85/plant) than non-inoculated plants (18/plant).

However, there was a similarity in total nodule weight per plant (126.5 mg/uninoculated plant and 115.5 mg/inoculated plant) due to a marked increase in weight of individual nodules and of their bacterial tissue on uninoculated plants (6.86 mg/one dry nodule of non-inoculated plant vs. 1.36 mg/one dry nodule of an inoculated plant). As a result of such similarity in nodule weight, the nitrogen content in the foliage and the amount of total nitrogen in the foliage of non-inoculated and inoculated plants were similar.

The grain yields (with seasonal rainfall of 343 mm) amounted in both cases to 126 kg/1000m^2.

Application of nitrogen fertilizer did not have a positive effect on chickpea yields in the area.

Effectivity of rhizobial populations specific for common vetch in southern Israel

Dvora Gurfel, Rina Löbel, J. Schiffmann and J. Finkel*

Yields of common vetch (*Vicia sativa*) in the southern part of Israel are generally considerably lower than those usually obtained in the north of the country. These differences do not always correspond to the different water regimes in the two districts.

In order to determine whether ineffectivity of local rhizobia could be the main reason for the very low yield level, an investigation was carried out to estimate the rate of effectivity in N_2-fixation of local rhizobial populations. The investigation involved rhizobial populations in soils of 13 farms scattered throughout the southern area. Evaluation was based on the following parameters: foliage dry matter, its nitrogen content, the amount of total nitrogen in the foliage, and the nitrogenase activity (as measured by acetylene-ethylene reduction assay). A comparison was carried out between common vetch inoculated with local

*Extension Service, Ministry of Agriculture.

rhizobia and plants inoculated with an effective specific rhizobial strain, non-inoculated vetch plants and N-fertilized plants.

The results showed that in all investigated soils, the local rhizobial populations could be classified as effective in spite of some variability in the degree of their effectivity. It can therefore be assumed that the main reason for the low yields of common vetch in the south stems from a deficiency in nutritional elements other than nitrogen.

Effectiveness of alfalfa symbiotic bacteria in northern Israel

J. Schiffmann and Rina Löbel

The present report relates to the alfalfa (*Medicago sativa*) symbiotic bacterial population occurring in the soils of one of the main alfalfa-growing centers in the north of Israel. Sixty-six isolates were tested for their effectivity in three separate trials.

All the isolates, except one, proved to be more or less effective. Although these isolates could be considered statistically effective or functional as compared with the control (non-inoculated plants), their effectiveness was likely not the highest, if one considers that the amount of total nitrogen in inoculated (with isolates) plants was significantly lower than that in plants fertilized with mineral nitrogen. N-uptake due to the most effective isolate reached only 57% of that achieved by nitrogen application. Moreover, the dry weight of plants fertilized with mineral nitrogen significantly exceeded that of plants inoculated with the various isolates.

The isolates differed significantly in their N-fixation activity and could therefore be classified into different groups, thereby showing the heterogeneity of the bacterial population in the soils tested.

Inoculation and fertilization trials with burr medic at Nir Am

J. Schiffmann, Rina Löbel, J. Rozolio* and M. Weitz*

Field trials of burr medic (Medicago polymorpha) inoculation were carried out during the 1976/77 winter season (sowing date: December 8, 1976) at Kibbutz Nir Am, in a semi-arid area (300-400 mm rainfall) of the northern Negev. The annual rainfall amount during the trial year was relatively large (410 mm). The soil was an uncultivated light loam, occasionally used for extensive grazing.

The main conclusions drawn from this investigation are as follows:

a) The native rhizobial population was not able to induce nodulation on M. polymorpha plants despite the fact that plants of local medics (M. truncatula and M. littoralis) were abundantly nodulated by the native rhizobial population. This indicates the narrow specificity of symbiotic bacteria for various species of medics.

b) Nitrogen fertilization (50 kg of ammonium sulfate per 1000 m^2) proved to be entirely unproductive under the conditions of the relatively rainy season of 1976/77.

c) Inoculation of M. polymorpha with specific rhizobial strains resulted in an effective supply of atmospheric nitrogen to the plants and in their greatly enhanced growth as compared with non-inoculated and nitrogen-fertilized plants.

d) Good results were obtained with direct seed inoculation, especially with a larger dose of inoculant. However, even better nodulation was achieved by spraying the soil, before sowing, with bacterial suspension and mixing the sprayed soil surface, to a depth of a few centimeters, by light harrowing.

e) Adequate phosphorus fertilization was necessary to obtain the best nodulation and the highest nitrogenase activity (acetylene-ethylene reduction assay).

*Extension Service, Ministry of Agriculture.

f) The average yield of foliage dry matter was *ca*. 180 kg/1000 m^2 with 35 kg of crude protein. In addition, there was 15-20 kg/1000 m^2 of seed available for self-reseeding in the next growing season.

Field experiments on burr medic inoculation at Nir Oz

Rina Löbel, J. Schiffmann, J. Rozolio* and M. Weitz*

During the winter seasons of 1974/75 and 1976/77, field inoculation experiments with burr medic (*Medicago polymorpha*) were carried out at Kibbutz Nir Oz, which is situated in a much more arid part of the Negev than Kibbutz Nir Am.

The two seasons were unusually dry (annual rainfall ∿ 100 mm only) and because of the late rainfall, sowing was done relatively late - January 20 and January 10, respectively. The soil was a nitrogen-poor sandy one.

The results of the trials can be summarized as follows:

a) The control - non-inoculated plants failed to nodulate, thereby indicating the absence of specific rhizobia in the soil of the area under consideration.

The dry foliage weight of non-inoculated plants averaged 34 kg/1000 m^2 in addition to 30.5 kg/1000 m^2 of dry pods containing 10 kg of seeds.

b) In contrast to the negative results at Nir Am, nitrogenous fertilization alone (50 kg/1000 m^2 of ammonium sulfate) had a positive effect on foliage dry weight, which averaged 73 kg/1000 m^2 in addition to 41 kg dry pods/1000 m^2 containing 16.14 kg of seeds. This positive effect at Nir Oz was apparently due to the small amount of rainfall being unable to leach the mineral nitrogen out of the root zone.

c) In the inoculated plots the dry matter weight of foliage averaged *ca*. 100 kg/1000 m^2 (with 3.18% nitrogen, or 19.9 kg crude protein/1000 m^2). In addition, the weight of dry pods in inoculated plots ranged from 46 to 68 kg/1000 m^2 and the seed weight from 15.6 to 21.7 kg/1000 m^2, depending on the inoculation technique and on the level of phosphorus fertilization.

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*Extension Service, Ministry of Agriculture.

d) Increasing levels of phosphorus alone (without inoculation) tended to raise the foliage weight, but the differences (on a dry matter basis) did not reach statistical significance, probably because of inadequate soil moisture, which hampered greater root development.

The highest yield of foliage was obtained with the combination of soil inoculation through spraying with bacterial suspension and application of 60 kg/1000 m^2 ordinary superphosphate.

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