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Medic inoculation experiments.

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DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

SUMMARY OF EXPERIMENTAL RESULTS
1982

MEDIC INOCULATION EXPERIMENTS

D.L. CHATEL

MEDIC INOCULATION EXPERIMENTS

Inoculation trials were conducted at Merredin Research Station and Merredin Research Station lease block to test a range of Rhizobia strains on a range of hosts for Rhizobial persistence in acid soils. The major objectives were:-

1. To test the field effectiveness of promising strains of Rhizobium meliloti and to compare them with standard strains.
2. To examine the performance in subsequent years of R. meliloti as colonizers of acid soils. The new strains included in this experiment represent promising isolates from acid soils in Sardinia. Their ability to persist will be determined by second and third year nodulation assessments.
3. To compare the performance of Medicago murex with previously used medic hosts under acid conditions.
4. To assess the effect of lime application on Rhizobial persistence in acid soils.

The strains used were:-

- U45 - Isolated from M. sativa. The strain used in commercial inoculants prior to 1983.
- CC 169 - Isolated from M. rugosa cv. paragosa, South Australia. The strain used in the commercial inoculant in 1983.
- Na 39 - Obtained from A.I.R.C.S. Collection.
- Na 2290 - Isolated from M. minima, obtained from A.I.R.C.S. collection.
- WSM 244 - Isolated from M. polymorpha collected at Tel Afer, Iraq, 1979.
- WSM 232 - Isolated from M. polymorpha collected at Tel Abta, Iraq, 1979.
- WSM 241 - Isolated from M. rotata collected at Duhok, Iraq 1979.
- WSM 303 - Isolated from M. rotata collected at Ninevah, Iraq, 1981.
- WSM 324 - Isolated from M. laciniata collected at West Safineh, Syria, 1981.
- WSM 329 - Isolated from M. polymorpha collected at Thadan, 1981.

Cont..2.

- WSM 383 - Isolated from M. arabica collected at Loceri, Sardinia, 1981.
- WSM 397 - Isolated from M. arabica collected at Ala Dei, Sardinia, 1981.
- WSM 407 - Isolated from M. murex collected at Albia, Sardinia, 1981.
- WSM 413 - Isolated from M. arabica collected at Palau, Sardinia, 1981.
- WSM 419 - Isolated from M. murex collected at S. Tempo Pausiana, Sardinia, 1981.
- WSM 429 - Isolated from M. Murex collected in Sardinia.
- WSM 441 - Isolated from M. murex or M. turbinata collected at Santa Lucia, Sardinia, 1981.

The host medics used were:-

Medicago truncatula cv. Cyprus.
Medicago littoralis cv. Harbinger
Medicago polymorpha cv. Serena
Medicago tornata cv. Tornafield
Medicago tornata cv. Swani
Medicago murex

1. NODULATION: Assessment based on the average value of 10 plants from replicates I and III harvested on September 8 and September 16 respectively.

A. PERCENTAGE OF PLANTS NODULATED

Host	Nil	U45	Na 2290	CC 169	Na 39	244	232	241	303	324	329	WSM 383	397	407	413	419	429	441
Serena	0	5	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Swani	0	100	100	100	90	95	95	100	90	100	90	100	95	95	100	100	100	100
Tornafield	1	100	95	100	95	95	75	100	95	100	100	100	100	100	100	100	100	100
Harbinger	0	95	85	90	100	100	95	100	100	100	95	100	95	95	95	85	95	100
Cyprus	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Murex	0	100	100	100	100	100	95	100	100	100	100	100	100	100	100	100	100	100

B. PERCENTAGE OF PLANTS WITH TAP ROOT NODULES

Host	Nil	U45	Na 2290	CC 169	Na 39	244	232	241	303	324	329	WSM 383	397	407	413	419	429	441
Serena	0	0	95	100	90	100	100	95	100	100	100	100	100	90	100	100	100	100
Swani	0	90	70	95	75	90	70	80	90	70	45	85	75	95	85	85	95	65
Tornafield	1	95	90	90	65	85	70	100	85	100	80	100	100	95	100	100	95	90
Harbinger	0	95	80	65	85	95	95	95	85	100	70	100	90	90	70	60	95	100
Cyprus	0	100	100	95	100	100	100	100	100	95	95	90	100	100	95	95	100	85
Murex	0	85	100	100	80	100	80	95	100	90	100	100	100	100	100	100	100	100

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C. TOTAL NUMBER OF NODULES

Host	Nil	U45	Na 2290	CC 169	Na 39	244	232	241	303	324	329	WSM						
												383	397	407	413	419	429	441
Serena	0	0.5	57	67	41	52	37	29	26	39	60	111	70	55	75	54	56	77
Swani	0	24	40	41	30	37	27	56	26	28	22	42	40	36	38	48	38	63
Tornafield	9	74	57	85	62	63	34	35	28	36	48	78	101	79	56	88	95	89
Harbinger	0	51	56	55	45	42	40	48	43	53	47	75	51	58	50	55	45	66
Cyprus	0	65	40	59	32	56	53	31	36	41	29	71	83	51	73	45	69	68
Murex	0	78	96	71	76	61	101	60	34	41	43	94	118	79	69	74	63	86
TOTAL	9	292.5	336	378	286	319	292	259	193	238	249	471	463	358	361	364	366	449

4.

D. NUMBER OF LATERAL NODULES

Host	Nil	U45	Na 2290	CC 169	Na 39	244	232	241	303	324	329	WSM						
												383	397	407	413	419	429	441
Serena	0	0.5	16	27	15	20	10	10	5	5	33	50	18	18	27	18	19	32
Swani	0	5	20	18	18	17	17	30	12	18	17	21	21	17	19	32	21	41
Tornafield	7	45	32	60	47	40	18	13	12	18	33	46	76	54	31	59	59	64
Harbinger	0	20	37	39	28	27	24	32	28	32	33	44	27	36	34	43	26	39
Cyprus	0	35	17	31	6	39	26	8	3	26	15	42	36	18	47	20	34	31
Murex	0	43	47	27	62	22	75	36	11	18	15	53	67	35	28	28	30	40
TOTAL	7	150.5	169	202	176	165	170	139	71	117	146	258	245	178	186	200	189	247

2. YIELD (g/plant D.W.)

Host												WSM						
	Nil	U45	Na 2290	CC 169	Na 39	244	232	241	303	324	329	383	397	407	413	419	429	441
Serena	0.05	0.08	0.45	0.39	-	0.37	0.47	0.30	0.45	0.43	0.42	0.25	0.34	0.27	0.42	0.29	0.43	0.38
Swani	0.08	0.24	0.25	0.29	0.25	0.28	0.26	0.30	0.15	0.16	0.18	0.23	0.18	0.22	0.45	0.29	0.27	0.12
Tornafield	0.14	0.45	0.35	0.30	0.40	0.38	0.39	0.38	0.34	0.42	0.15	0.50	0.53	0.33	0.40	0.54	0.35	0.30
Harbinger	0.11	0.25	0.25	0.28	0.38	0.21	0.27	0.25	0.23	0.16	0.23	0.24	0.24	0.15	0.28	0.24	0.21	0.09
Cyprus	0.10	0.44	0.35	0.37	0.28	0.34	0.27	0.31	0.38	0.37	0.27	0.31	0.26	0.36	0.38	0.30	0.36	0.48
Murex	-	0.08	0.36	0.56	0.09	0.56	0.26	0.47	0.35	0.44	0.37	0.48	0.47	0.51	0.42	0.34	0.33	0.38
Column Av.	0.10	0.26	0.34	0.37	0.28	0.36	0.32	0.34	0.32	0.33	0.27	0.34	0.34	0.31	0.39	0.34	0.32	0.29

3. SEED YIELD (g/metre) - Mean of Reps 1, 2 and 3. Rep 4 omitted due to mix up of bags.

Host												WSM						
	Nil	U45	Na 2290	CC 169	Na 39	244	232	241	303	324	329	383	397	407	413	419	429	441
Serena	0.53	0.41	11.4	9.66	0.25	9.08	10.9	8.13	8.59	9.19	10.6	11.1	8.95	9.28	9.86	11.3	9.46	11.0
Swani	0.32	6.60	4.63	4.65	4.62	5.83	4.32	5.82	3.50	3.50	6.49	4.19	4.31	4.43	3.99	6.56	4.23	4.76
Tornafield	0.25	7.62	3.59	8.25	4.11	5.99	5.73	4.07	3.08	3.54	3.65	4.40	5.35	4.81	7.46	5.54	5.23	4.61
Harbinger	0.22	6.30	3.17	3.14	4.26	5.22	5.07	6.90	2.60	3.65	3.51	2.69	5.62	2.12	4.51	2.81	1.84	0.92
Cyprus	0.59	4.86	6.60	9.77	6.83	11.7	9.40	6.78	6.40	11.8	9.18	8.96	8.90	8.96	6.98	6.76	8.14	8.21
Murex	0.15	0.36	8.77	5.43	1.92	8.66	1.06	16.6	6.20	8.33	9.59	6.45	7.40	5.15	9.03	7.98	6.64	7.76
Totals	2.06	26.2	38.2	40.9	22.0	46.5	36.5	48.3	31.4	39.0	43.1	37.8	40.0	34.7	41.8	40.9	35.5	37.3

. GROWTH RATING - 9TH SEPTEMBER, 1982

HOST	Nil	U45	Na 2290	CC 169	Na 39	244	232	241	303	324	329	WSM 383	397	407	413	419	428	441
Serena	0.88	0.63	3.00	2.80	1.63	2.00	2.25	1.63	1.75	2.38	2.88	2.13	2.38	2.38	2.50	1.88	2.50	2.75
Swani	1.00	1.75	1.88	2.50	2.38	2.25	1.50	2.50	1.50	1.25	1.25	2.00	2.38	1.63	1.63	3.00	1.88	1.63
Tornafield	0.38	1.88	1.25	1.38	1.13	1.38	1.88	1.13	1.38	1.13	1.13	1.50	1.38	1.00	1.25	1.25	1.63	1.13
Harbinger	0.88	2.13	1.00	1.25	1.50	2.00	1.63	1.63	1.75	1.75	1.13	1.50	1.88	1.25	1.75	1.88	1.88	1.25
Cyprus	0.69	2.13	1.88	2.63	1.63	3.38	2.25	2.13	1.88	2.63	2.25	1.50	2.25	2.50	1.88	2.50	2.13	2.75
Murex	1.38	0.50	2.75	2.75	0.88	1.38	0.63	2.38	2.13	2.75	2.63	2.50	2.25	2.75	2.50	2.25	2.75	2.25
COLUMN AV.	0.87	1.50	1.96	2.22	1.53	2.07	1.64	1.90	1.73	1.98	1.88	1.86	2.09	1.92	1.92	2.13	2.13	1.96

COMMENTS

1. All treatments were lime pelleted to ensure successful establishment of the trial. The major assessment of acid tolerance therefore will be second and third year results.
2. It is worth noting at this stage however:-
 - (a) the large number of both total and lateral nodules formed by isolates WSM 383, 397 and 441, originally from nodules collected in Sardinia. This indicates an ability of the Rhizobia to move through soil and infect lateral roots under acid conditions.
 - (b) the excellent yield and nodulation performance of Medicago murex with most rhizobial strains.
 - (c) the significant correlation between dry weight yield and seed yield averaged over hosts of each strain (0.6220** excluding controls).
 - (d) the low correlation between number of lateral nodules and both yield and seed yield of rhizobial strains averaged over hosts (0.1669 and 0.1142).
 - (e) the promising yield performance of hosts inoculated with strains CC 169 (commercial inoculant), WSM 244 and WSM 413.