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RESULTS OF 1975-76 SOYA BEAN TRIALS IN CERTAIN SOUTH PACIFIC TERRITORIES

Early in 1975, the South Pacific Commission approached the International Soybean Program of the University of Illinois, USA (INTSOY) to determine whether it would be possible to conduct soybean variety trials in Pacific territories wishing to participate.

The prospects for soybean in the islands are admittedly subject to reservations; at the present time it has no potential as a human food, and all experiments along these lines with non-Asian peoples have led to failure. On the assumption however, that soybean production is geared either to industrial processing into locally used products, or to export of locally produced seed, oil or cakes, the agronomical research findings will give a first indication of the viability of soybean if not as a large-scale crop, at least on a level compatible with local economic and technical limitations.

In some territories, the sharp rise in the consumption of pig and poultry feed, the low production of high-protein plant products, and, to an even greater degree, the policy of curbing imports, have opened, or are about to open, new horizons for the processing of soybean to cater for the local market.

A major agronomical advantage of soybean is its short season thus, it can be grown in family gardens either as a catch crop or as a forerunner to food crops. A further advantage is that, being a legume, it contributes nitrogen to the soil thus improving it for subsequent crops, and leaves the ground clean, reducing the substantial amount of work made necessary by the proliferation of weeds early in the rainy season. As a large-scale crop, it could be rotated twice yearly with cereals (corns, sorghum, rain-fed rice, etc.). In short, soybean is attractive both as a soil-improving crop and because of the fact that under mechanization it calls for the same equipment as cereals, thereby reducing capital outlay.

While soybean trials have already been conducted (New Caledonia, Tonga, Fiji, etc), to our knowledge only Tonga has made a thorough study of seasonality. The soybean, however, is highly responsive to photoperiod (i.e. the occurrence of flowering is directly influenced by day length); thus the date of planting is most important, and in addition a large number of varieties must be introduced during the initial phase of trials. This requirement was met last year when INTSOY provided us with 15 varieties.

Together with seeds INTSOY supplies the inoculum (Rhizobium japonicum) required for their inoculation, experimental directions, and an observation handbook by which the development of the plant may be followed from planting to harvesting. Chemical assays of the various seed varieties are of course conducted at the University of Illinois, in order to determine protein content in particular.

This Circular gives the first results of trials in certain Pacific territories. They vary greatly and must be interpreted with caution, as they refer to small areas cultivated for the purpose of research. That being said, two territories at least have produced good

and promising results; most varieties yielded over 2,000 kg/ha in New Caledonia and French Polynesia, and some exceeded 4,000 kg/ha in the latter territory. At first sight the date of planting would seem to account for these high yields, confirming the need for great attention when fixing dates.

Here, to conclude, are the comments of the head of the French Polynesian Rural Economy Department concerning the 1975-76 yields achieved in his territory: "As a consequence of these encouraging results, we intend to continue the programme (variety trials) on a larger scale, so as to assess the true technical and economic potential of soybean cultivation in French Polynesia. If our expectations are borne out, we would consider local production of the raw materials required to make composite foods that will stimulate the development of stock-raising and aquaculture".

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Tropical Agriculturalist

I. FIJI

The 15 soybean varieties introduced to Fiji by INTSOY seem unsuited to the local environment. Trials took place at Legalega, near Nadi (Viti Levu) and at Bua (Vanua Levu).

Previous trials using varieties taken from countries on a latitude comparable with that of Fiji yielded better results.

Fiji has however maintained its interest in the on-going programme. Trials will be resumed once varieties compatible with local peculiarities have been found, and a local use for soybean agreed upon.

II. NEW CALEDONIA

Trials covered 15 varieties, sown in full randomized blocks, with four replicates. Each sub-plot comprises four 5 m. rows at 60 cm. intervals.

Schedule of trials

- Date of planting: December 10, 1975

Blooming is responsive to photoperiod: it is brought on by the decrease in day length. According to the sensitivity of individual varieties, a greater or lesser decrease is required.

In the southern hemisphere, the day begins to shorten on 21 December; to permit plant growth before flowering, the best planting period would appear to be from 20 November to 15 December, again depending on the responsiveness of the varieties.

December 10 was chosen for planting to fit in with ground use at that time.

- Previous crop: corn
- Fertilizer: 80 phosphorus units/ha, i.e. 250 kg of superphosphate per hectare
  100 potassium units/ha, i.e. 200 kg of potassium sulphate per hectare.
- Inoculation: The inoculum (Rhizobium japonicum) was mixed with fertilizer immediately before planting.

Harvesting

Once 95 per cent of seeds have reached maturity, pods are hand-picked and laid out to dry in heaps; one for each sub-plot, before threshing. Maturity begins approximately two months after flowering.

Though mechanization is possible, the use of combine harvesters with these varieties involves loss of the first pods which occur less than 10 cm. from ground level.

The resulting loss may be evaluated at 10 per cent of the harvest.

During the vegetative period, the crop was not irrigated but received 428.2 mm of rainfall.

Results

Varieties	Number of days from planting to flowering	Average height in cm	Lodging 0 - none 1 - less than 25% 2 - 25 to 50 % 3 - 50 to 80 % 4 - almost 100 % blossomless	Average yield in t/ha	
Colombus	33	100	1	3.08	
Hampton 2664	53	65	2	2.78	
Bossier	53	70	0	2.62	
Callande	33	100	2	2.55	
Hardee	53	75	2	2.53	
Pickett 71	33	70	2	2.53	
Davis	53	70	1	2.29	
William	29	80	1	2.24	
Semmes	53	75	1	1.92	
Jupiter	69	120	4	1.80	
Forest	47	60	2	1.58	Irregular flowering
Woodworth	29	60	0	1.30	
Tracy	40	60	0	1.12	
Coob	40	65	0	0.99	Very poor seed emergence: further trial necessary for comparison
Clark 63	40	60	0	0.43	

Conclusion

The great majority of plants did not reach a height of 1 m, indicating that planting should occur around 1 December to enable the plant to develop, with the exception of the Jupiter variety which should be planted during the latter half of December.

The first six varieties yielded over 2.5 t/ha. whereas a good yield in France, under dry cultivation, would be 2.2 - 2.7 t/ha. Soybean could be grown in New Caledonia, but good seed emergence would require irrigation at the time of planting.

III. FRENCH POLYNESIA

I - Purpose of trials

To determine the feasibility of soybean cultivation in French Polynesia, and define the variety or varieties best suited to local conditions.

II - Site

The trials were conducted at the Papara Experimental Station, route de la Carrière, Tahiti. under the responsibility of M. Robert Yau (Akui).

III - Description of trials

A. Preliminary trial of six varieties in single plots, from 11/6/1975 to 16/9/1975

1. Varieties

BERTOUA (I.R.A.T.* - Bouake Station, Ivory Coast)
PELICAN IMPROVED - id -
BOSSIER - id -
KENT - id -
JUPITER - id -
C.E.S. - id -
KAILUA (University of Hawaii, Honolulu)

2. Operations

- Fertilization

Fertilizers, expressed in kg/ha applied before planting:

Urea	Superphosphate	Potassium chloride
150	250	500

- Chemical weed control before planting: Trifluraline (Treflan: 2.5 kg/ha)
- Planting at 20 cm. intervals in rows 40 cm. apart (125.000 seeds/ha)
- Inoculation of seeds with tropical inoculum No. 1 (Rhizobium japonicum) immediately prior to planting.
- Size of individual plots: 4 x 7 m = 28 m^2.
- Single plots only
- Protective treatments: AZINPHOS-METHYL + BENOMYL + OLIGO-ELEMENTS - fortnightly

3. Results observed

a) Climatic data

Month	Rainfall (in mm)	Average temperatures (in d°C)	
		Minimum	Maximum
July	54.6	19.2	27.5
August	91.4	18.5	26.1
September	41.9	19.1	26.9
Total	187.9	—	—

* Institut de recherches agronomiques tropicales et des cultures vivrières

b) Harvests

Varieties	Berthoua	Pelican	Bossier	Kent	Jupiter	C.E.S.	Kailua
Harvest commenced	11/9/75	11/9/75	11/9/75	16/9/75	16/9/75	16/9/75	11/9/75
Harvest ended	16/9/75	16/9/75	16/9/75	30/9/75	30/9/75	30/9/75	16/9/75
Crop duration (in days)	97	97	97	106	106	106	97
Total weight harvested (kg per 28m² plot)	7.800	4.800	7.600	5.000	7.400	6.800	5.400
Plants harvested (%)	93.7	81.7	100.0	39.7	100	100	100
Average yield (t/ha)	2.875	1.714	2.714	1.785	2.643	2.428	1.928

c) Observations

Throughout the cycle vegetation was excellent for all varieties, and seeds harvested were of very good quality.

4. Conclusion

On the basis of this preliminary trial, the soybean varieties tested may be assessed as follows:

Classification	Variety	Average yield (t/ha of dried seeds)	Crop duration (days)
1	Berthoua	2.785	97
2	Bossier	2.714	97
3	Jupiter	2.643	106
4	C.E.S.	2.428	106
5	Kailua	1.928	97
6	Kent	1.785	106
7	Pelican	1.714	97

B. Trial conducted from 3/12/1975 - 12/4/1976

This trial was conducted under INTSOY's 1975 programme, for which SPC acted as Pacific coordinator, in accordance with directions provided by the University of Illinois (Urbana, USA).

1. Varieties tested

1 = JUPITER
2 = HAMPTON 2664
3 = HARDEE
4 = PICKETT 71
5 = COBB
6 = BOSSIER
7 = DAVIS
8 = TRACY
9 = FORREST
10 = COLUMBUS
11 = CLARK 63
12 = WOODWORTH
13 = WILLIAMS
14 = CALLAND
15 = SEMMES

2. Operations

- Fertilization (during land preparation)
  Fertilizer applications expressed in kg/ha:

Urea	Supertriple	Potassium chloride
0	50	125

- Chemical weed control; TRIFLURALINE prior to planting (2.5 kg/ha of TREFLAN).
- Inoculation - 14 kg/ha of powdered inoculum spread and buried along seed rows immediately before planting.
- Planting - 332,000 seeds/ha at 5 cm. intervals in rows 60 cm. apart.
- Plots of four 5 m. rows (area 5 m. x 2.4 m. = 12 m^2.), randomized
- Four replicates.

Block layout

Block I	Block II	Block III	Block IV
10	2	14	9
4	10	7	10
3	14	12	11
6	1	13	15
12	13	2	3
11	4	15	8
9	15	6	2
7	5	4	12
15	3	8	4
1	12	10	14
5	8	3	7
2	7	5	1
14	9	11	6
13	11	9	5
8	6	1	13

3. Results

a) Climatic data

Month		Rainfall (in mm)	Average temperatures (in d°C)	
			Minimum	Maximum
December	1975	303.6	20.6	29.1
January	1976	102.8	?	29.9
February	1976	101.3	(?)	29.6
March	1976	53.8	20.5	30.3
April	1976	121.5	21.1	31.3
Total		683.0	—	—

b) Soil

- Brown clay and sand soil, few stones, deep water retention.

Average characteristics

Loam	30%
Clay	31%
Sand	28.9%
pH	7.3
Organic matter	5.19%
N‰	1.68‰
P_2O5‰	1.37‰
K_2O‰	0.55‰

c) Harvest results

Harvesting took place from 15/3 to 12/4/1976.
Only the weights harvested on half of each plot (2 out of 4 rows) were noted.

Total harvests from half-plots of $6m^2$ (in g.)

Varieties	Block I	Block II	Block III	Block IV	Total	Average
1	2,200	1,860	3,000	880	7,940	1,985
2	1,700	400	60	3,400	5,560	1,390
3	1,540	3,200	160	40	4,940	1,235
4	1,580	2,800	1,320	3,200	8,900	2,285
5	380	1,960	1,320	1,480	5,140	1,285
6	2,200	3,200	3,200	380	8,980	2,245
7	1,220	1,540	1,720	260	4,740	1,185
8	3,200	1,180	3,000	3,400	10,780	2,695
9	3,000	2,200	2,800	1,640	9,640	2,410
10	1,120	1,240	3,000	3,000	8,360	2,090
11	2,800	2,800	2,100	2,800	10,500	2,625
12	340	2,600	1,700	2,200	6,840	1,710
13	2,400	80	2,400	2,400	7,280	1,820
14	2,000	1,100	720	140	3,960	990
15	2,600	3,400	3,000	2,800	11,800	2,950

Dry weight harvested on 6m² half-plots (in g.)

Varieties	Block I	Block II	Block III	Block IV	Average for 6m²	Average yield in kg/ha
1 Jupiter	993.7	359.6	126.8	1,468.3	866.875	1,445.08
2 Hampton 2664	1,393.1	1,090.7	1,524.8	2,650.5	1,664.775	2.775.180
3 Hardee	1,343.3	943.7	1,493.5	2,525	1,576.375	2,624.820
4 Pickett 71	1,927.6	1,637.4	2,148.7	2,414.7	2,025.5	3,376.51
5 Cobb	293.5	69.6	53	35.4	112.875	188.100
6 Bossier	2,467.9	1,181.3	2,654.1	3,090.6	2,680.425	4,468.27
7 Davis	2,695.8	3,069.5	2,888.6	3,108.6	2,940.625	4,902.02
8 Tracy	1,093	1,713.8	1,181.3	1,997.8	1,496.475	2,494.62
9 Forrest	2,695.8	2,874.6	2,703	2,925.8	2,713	4,522.57
10 Columbus	1,939	2,331.2	2,753.7	126.8	1,787.675	2,980.05
11 Clark 63	337.7	1,059.3	141.1	229.8	441.975	736.6
12 – Woodworth	1,513	1,384.9	1,168.2	763.1	1,207.3	2,012.57
13 Williams	1,779.8	1,982.4	1,859.1	347.2	1,492.125	2,487.37
14 Calland	2,111.3	2,516.4	2,461.2	1,322.1	2,102.75	3,505.28
15 Semmes	2,897.3	2,561.1	2,683.5	2,148.7	2,646.15	4,413.63

d) Formation of root nodules

The following observations were made on Rhizobium japonicum nodule development taking all plots into account.

Nodules harvested (in kg/ha)

Varieties	Weight harvested during flowering (kg/ha)	Weight harvested 3 weeks later (kg/ha)
1 Jupiter	110	342
2 Hampton 2664	255	496
3 Hardee	169	382
4 Pickett 71	125	317
5 Cobb	126	362
6 Bossier	133	216
7 Davis	135	330
8 Tracy	106	294
9 Forrest	256	623
10 Columbus	256	442
11 Clark 63	238	397
12 Woodworth	188	427
13 Williams	148	288
14 Calland	347	556
15 Semmes	159	259

e) Resistance

Well-developed vegetation, no apparent damage: attacks by Adoretus sinicus in the latter part of the cycle (insignificant)

4. Conclusion

The varieties tested may be classified as follows:

Classification	Varieties	Average yield expressed in t/ha of dried seed	Number of days from planting		Nodules harvested in kg/ha of dry matter		Average plant height in cm
			till flowering	till harvest	during flowering	3 weeks later	
1	Davis	4.902	40	111	209	410	70 4
2	Forrest	4.523	33	95	85	205	58.8
3	Bossier	4.468	33	112	173	329	47.8
4	Semmes	4.414	33	118	139	268	43.8
5	Calland	3.505	33	110	151	294	79.3
6	Pickett 71	3.377	33	131	129	218	40.3
7	Columbus	2.980	33	92	155	412	73.7
8	Hampton 2664	2.775	33	132	165	395	54.8
9	Hardee	2.628	45	131	402	664	65.0
10	Tracy	2.495	33	109	145	347	46.0
11	Williams	2.487	33	92	138	287	60.0
12	Woodworth	2.013	33	92	103	322	51.8
13	Jupiter	1.445	61	146	457	793	95.6

IV. TONGA

Jupiter was planted at one-month intervals on small plots to evaluate its growth and ve vegetative cycle in terms of day length. Results were as follows:

Growth of Jupiter soybean variety in relation to date of planting

Date of planting	Number of days until flowering (50% of plants)	Number of days from planting till harvesting	Plant height (in cm) at harvest
21/03/75	45	116	31
28/04/75	46	115	37
8/05/75	46	117	40
11/06/75	46	120	43
10/07/75	47	137	52
13/08/75	49	194	40
28/08/75	56*	no harvest	
11/09/75	65*	201	87
10/10/75	87*	199	79
25/11/75	69*	157	98
10/12/75	65*	149	75
12/01/76	53	120	68
16/02/76	43	107	30

* Though flowering commenced at this date, most flowers failed

The planting season for Jupiter in Tonga is from January till July; bearing in mind the plant's short cycle, yields are good.

Planting in late August and September led to failure to flower, and negligible or even non-existent yields.

While planting from October through January gave virtually the same results, January appeared the most suitable month: soybean planted from October to December appears to have an unduly long cycle. Crops planted on 10/10/75, 25/11/75, 10/12/75 and 12/1/76 were harvested on 26/4/76, 30/4/76, 7/5/76 and 11/5/76, thus reaching maturity at approximately the same time.

ISSUED IN THIS SERIES

		Classification
1.	Annual Conference of O. I. E. held in Paris 13th - 18th May, 1968. Report of S. P. C. Observer. September 1968.	Livestock Production and Health
2.	South Pacific Commission Publications Series. October 1968.	Publications
3.	Free Diving Without Breathing Apparatus - Its Accidents. March 1969.	Public Health
4.	"A" Level: Australia's Notification on Bovine Pleuropneumonia Regulations. March 1969.	Plant and Animal Quarantine
5.	Study Tour to Noumea. Brisbane, Territory of Papua and New Guinea and British Solomon Islands Protectorate. March 1969.	Tropical Crops
6.	"A" Level: Agricultural Education - Bulletin N° 1. April 1969.	Agricultural Education and Extension
7.	Introduction and Spread of Culicoides and Other Insect Species by Aircraft. May 1969.	Public Health
8.	Diarrhoeal Diseases in Adults. May 1969.	Public Health
9.	"A" Level: Agricultural Education - Bulletin N° 2. May 1969.	Agricultural Education and Extension
10.	"A" Level: Agricultural Education - Bulletin N° 3. November 1969.	Agricultural Education and Extension
11.	Agricultural Extension Workshop - Western Samoa. November 1969.	Agricultural Education and Extension
12.	Asian-Pacific Weed Science Society. December 1969.	Tropical Crops
13.	The Status and Potential of the Chilli Industry in the Solomon Islands. December 1969.	Tropical Crops
14.	Manpower Planning in the South Pacific. March 1970.	All

15.	Fibreglass Water Tanks. April 1970.	Public Health Engineering
16.	U. N. World Youth Assembly. May 1970.	Social Welfare and Youth
17.	News and Views from the Journals. June 1970	Public Health
18.	Acute Rheumatism and Chronic Rheumatic Carditis in Fiji. June 1970.	Public Health
19.	Public Health Problems of Gonorrhoea and Syphilis. June 1970.	Public Health
20.	Clinical Aspects and Diagnosis of Leprosy. June 1970.	Public Health
21.	News and Views from the Journals 2 : On Insects and Their Control. June 1970.	Public Health Environmental Health and Vector Control
22.	Breadfruit Diseases in the South Pacific. June 1970.	Tropical Crops
23.	Second World Consultation on Forest Tree Breeding. June 1970.	Forestry
24.	Agricultural Research in the South Pacific July 1970.	Tropical Crops Livestock Production and Health
25.	Crown-of-Thorns Starfish. July 1970.	Fisheries
26.	Counter-Attack - Crown-of-Thorns Starfish. September 1970.	Fisheries
27.	A Simple Field Test for Determination of Salinity of Water Supplies. December 1970.	Public Health
28.	Asian Coconut Community. January 1971.	Tropical Crops
29.	O. I. E. /F. A. O. Regional Conference on Epizootics in Asia, the Far East and Oceania. January 1971.	Livestock Production and Health
30.	Plant Pest Control. January 1971	Tropical Crops Plant and Animal Quarantine

31.	The Effect of Cultural Method and Size of Planting Material on the Yield of Colocasia esculenta. February 1971.	Tropical Crops
32.	Shell-fish and Public Health. April 1971	Public Health Engineering
33.	Weed Control. August 1971.	Tropical Crops
34.	Taro. August 1971	Agricultural Research
35.	Transmission of Virus Samples. August 1971.	Plant and Animal Quarantine
36.	Amyotrophic Lateral Sclerosis and Parkinsonism-Dementia in Guam. September 1971.	Mental Health
37.	Training Programmes for Out-of-School Rural Youth. March 1972.	Agricultural Education and Extension
38.	Control of Aedes aegypti, the Vector of Dengue. September 1972.	Vector Control
39.	Coconut Water as an Emergency Parenteral Fluid. September 1972.	Public Health
40.	Viral Hepatitis. October 1972.	Hepatology
41.	Biological disc treatment of waste waters. December 1972.	Public Health Engineering
42.	The Monitoring of Sewage Treatment Plants. December 1972.	Public Health Engineering
43.	The Fifth FAO Regional Conference on Animal Production and Health in the Far East. December 1972.	Livestock Production and Health
44.	The Septic Tank. January 1973.	Public Health Engineering
45.	How to deal with the sludge produced by sewage farms in the South Pacific. January 1973.	Public Health Engineering
46.	The convenience of the metric system. February 1973.	Public Health Engineering

47.	Useful References for Animal Production and Agricultural Extension Workers of the South Pacific Commission territories. March 1973.	Animal Production
48.	Twelfth World Congress of Rehabilitation (Sydney, Aug. 27 - Sept. 1, 1972). March 1973.	Mental Health
49.	Primary Amoebic Meningo-Encephalitis. April 1973.	Epidemiology
50.	South Pacific Agricultural Extension Survey - 1967. April 1973.	Agricultural Education and Extension
51.	Collection and Shipping of Serum Specimens for Antibody Studies. May 1973.	Public Health
52.	Fruit Cultivation. June 1973.	Tropical Crops
53.	Recent Developments in Education in the South Pacific. August 1973.	Education
54.	Shellfish Poisoning in the South Pacific. February 1974.	Public Health Fisheries
55.	Special Project - Vegetable Production in the South Pacific. January 1974.	Tropical Crops
56.	Comments on Experiments Recently Undertaken in some Pacific Islands on certain varieties of Vegetables. March 1974.	Tropical Crops
57.	Regional Planning. March 1974.	Economic Development
58.	Some Aspects of Pasture Research and Development. April 1974.	Livestock Production
59.	Something New in Sewerage : The Bio-drum. September 1974.	Public Health
60.	Solar Energy. Economic appraisal of a solar water heater. November 1974.	Public Health
61.	Sewage Treatment in the Pacific - Mini Glossary of Terms Used. November 1974.	Public Health

62.	Potential of Animal Feed Production in Western Samoa. November 1974.	Livestock Production and Health
63.	Names of Food Plants in Niue Island (South Pacific). November 1974.	Nutrition Tropical Crops
64.	Some Effects of Temperature on Pasture Germination and Growth. April 1975.	Livestock Production and Health
65.	The Marketing of Fresh Vegetables. May 1975.	Vegetable Production
66.	Special Project on Vegetable Production - Results of 1974 Variety Trials. June 1975.	Tropical Crops
67.	Principal 1974 Vegetable Growing Results for the Pirae Agricultural Research Station, Tahiti (French Polynesia). June 1975.	Tropical Crops
68.	Evaluation of Broiler (Meat Chicken) Performance. September 1975.	Livestock Production and Health
69.	Towards a Better Mosquito Control Policy. September 1975.	Public Health
70.	Bronchiogenic and Lung Cancer in the South Pacific. September 1975.	Public Health
71.	Preliminary Information on the Intestinal Parasites of Livestock in Tongatapu, Tonga. March 1976.	Animal Production and Health
72.	Expérimentation fourragère en Polynésie Francaise. Mars 1976. (will not be issued in English).	
73.	Not yet available in English	
74.	Diabetes Mellitus. April 1976.	Public Health
75.	Observations on the Generation of Methane. September 1976	Public Health