CHINESE-AMERICAN

JOINT COMMISSION ON RURAL RECONSTRUCTION

Plant Industry Series No. 17

A REPORT ON THE TAIWAN FIELD RAT CONTROL CAMPAIGN

By

Horng, Wei Huai

TAIPEI, TAIWAN, CHINA

JUNE 1959

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FOREWORD

The present pamphlet is designed to report on the experimentation (1955/6), demonstration (1956/7) and the details of an Island-wide field rat eradication campaign (1957/8) in Taiwan. It may serve as an illustration as to how could a technical program be actually carried down to 817,540 small farms to produce collectively a significant result when carefully planned and measures for the implementation of the program thoroughly coordinated.

Credit for the success of the program should be given to Messrs. S. K. Cheng and T.C. Foh of the Taiwan Sugar Corporation who first experimented and recommended the use of warfarin-brown-rice bait for rat control in sugarcane field; to Dr. S.H. Ou of JCRR and Messrs. T.N. Chen of the Taiwan Agricultural Research Institute and T. D. Wang of the Taiwan Provincial Department of Agriculture and Forestry, who masterminded the baiting experiments in fields of rice and other crops and demonstrations in fourteen townships, which set the pattern for the organization of the later Island-wide campaign.

It were Mr. T. D. Wang of PDAF and Mr. W. H. Horng, specialist of JCRR and author of this pamphlet, who contributed most to the planning and organizing of the all-out campaign. Mr. Wang, head of the Plant Protection Section of PDAF, was ably assisted by the staff of his section and specialists recruited from the Provincial Food Bureau, Provincial Farmers' Association, Taiwan Sugar Corporation and various experiment stations in supervising the implementation of the program. Last but not least, the program would not have been so successful without the whole-hearted cooperation of the agricultural workers of all prefectural governments, township offices, village chiefs and all levels of farmers' associations.

To all those whose loyalty and untiring devotion made the campaign a shining example of Taiwan's rural program, the reward is the gratification that an extremely complicated and difficult job has been well done in an examplary manner, as may be signified by a commendatory airgram from Mr. James H. Smith, Director, ICA/W, to JCRR in August 1958: "Taiwan's field rat control project represents conclusively the accomplishments that can be achieved when adequate planning, supervision, and cooperation of all concerned precede and exist during the implementation activities."

The population of the field rat may build back again in the ensuing years;

but from the experience of the last campaign, all farmers are now well familiar with the method of control, so, they shall be able to continue the work by themselves with some further guidance from the government offices.

H. T. Chang
Chief, Plant Industry Division, JCRR,
and
Chairman, Taiwan Provincial Field Rat
Control Committee (1957/8)

June 1959

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A Report on the Taiwan Field Rat Control Campaign

I. Introduction

Like in all tropical and sub-tropical countries, field rats have caused serious crop damage in Taiwan. Several methods had been tried to countrol the pest. Under the Japanese occupation, rodenticide made of yellow phosphorus was first used as bait in 1926. Dog hunting was officially encouraged in 1933, and rat traps were widely extended in 1936. In more recent years, "1080" made in Japan bearing the commercial name of "Fratol", a deadly poisonous chemical, was introduced for use in towns and in rural areas by commercial importers. Other rodenticides such as Antu, red squill, etc. were tried, but all were effective in only limited ways.

Scientific study on field rat control was first started in 1950 by the Taiwan Sugar Research Institute of the Taiwan Sugar Corporation (TSC) for protecting the sugarcane crop. Through series of field tests and laboratory researches made by the Taiwan Sugar Research Institute and the Pingtung Sugarcane Improvement Station of TSC, a plan was finally worked out for field rat control in TSC-owned farms, using warfarin as poison and brown rice and



Rat damage on sugarcane crop—biting off the lower portion of the stem so the whole cane dries up.

peanut oil as bait materials. Various types of containers (bait stations) were suggested to hold the bait in the field. The baits were also made into small cakes for easy placement in the field. Their program of field rat control in cane fields expanded from 1,000 ha. of controlled area in the 1953/54 sugarcane crop to cover all of the 186 Corporation farms of about 40,000 ha. and some 15,000 ha. of contracted farms in the 1957/58 sugarcane crop. The program was quite successful in protecting the sugarcane fields. However the program could only keep baited farms free from rats for 4 to 8 months. The rats in the adjacent farms reestablished colonies in the treated farms after baiting was over. So the operation has to be repeated every year.

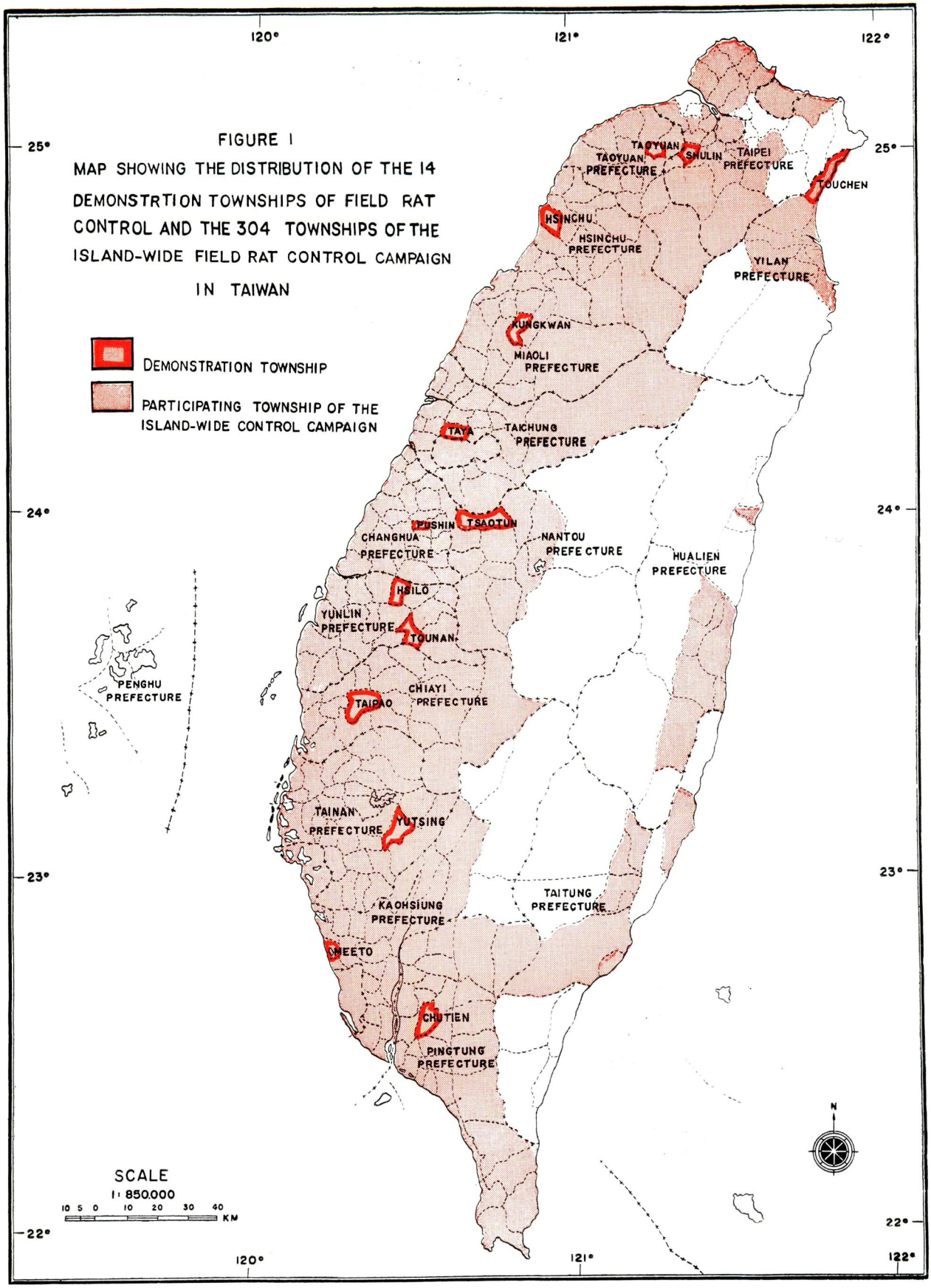
During the past few years, the Joint Commission on Rural Reconstruction (JCRR) received increasing number of complaints of rat damage on many crops including rice, peanut, sweet potato, vegetables, etc. and requests for assistance to control the field rats. But at the time, it was not sure whether the methods adopted by the Taiwan Sugar Research Institute were applicable to other crops, since sugarcane offers different field habitat and type of food for rats. In June 1955, a project was conducted jointly by the Taiwan Agricultural Research Institute and the Tainan District Agricultural Improvement Station with JCRR technical and financial assistance to study the bait and bait stations to be used, the living and migratory habits of rats, the best time and method of baiting in fields of crops other than sugarcane.

Based upon past experiences and information obtained from these studies, the following two major principles were evolved:

1. The control program is to be carried out in large area to cover all crop fields as well as waste land instead of protecting particular crop in scattered small fields. It also includes farm families in villages which have population of not more than 10,000.

2. Selecting the best time of the year for baiting, i.e., the time when food for rats are least available, so the rats would be in hunger and concentrated in fields where food is available and at time when weather conditions are fair.

In 1956/57 winter, a demonstration project was conducted by the Provincial Department of Agriculture and Forestry with JCRR assistance in 14 townships of 13 prefectures. Excellent result was obtained. In the following winter, 1957/58, an island-wide field rat eradication campaign was carried out with the participation of 304 townships, including nearly all the townships on the plain on the main island of Taiwan. To organize and implement the campaign a Taiwan Field Rat Control Committee was formed with the representation of the Provincial Department of Agriculture and Forestry (PDAF), Provincial Food Bureau (PFB),


FIGURE 1
MAP SHOWING THE DISTRIBUTION OF THE 14 DEMONSTRTION TOWNSHIPS OF FIELD RAT CONTROL AND THE 304 TOWNSHIPS OF THE ISLAND-WIDE FIELD RAT CONTROL CAMPAIGN IN TAIWAN
DEMONSTRATION TOWNSHIP
PARTICIPATING TOWNSHIP OF THE ISLAND-WIDE CONTROL CAMPAIGN
120°
121°
122°
25°
24°
23°
22°
TAOYUAN
TAOYUAN PREFECTURE
SHULIN
TAIPEI PREFECTURE
TOUCHEN
HSINCHU
HSINCHU PREFECTURE
YILAN PREFECTURE
KUNGKWAN
MIAOLI PREFECTURE
TAYA
TAICHUNG PREFECTURE
PUSHIN
TSAOTUN
CHANGHUA PREFECTURE
NANTOU PREFECTURE
HUALIEN PREFECTURE
HSILO
YUNLIN PREFECTURE
TOUNAN
PENGHU PREFECTURE
CHIAYI PREFECTURE
TAIPAO
TAINAN PREFECTURE
YUTSING
TAITUNG PREFECTURE
KAOHSIUNG PREFECTURE
MEETO
CHUTIEN
PINGTUNG PREFECTURE
N
SCALE
1: 850,000
10 5 0 10 20 30 40 KM

Taiwan Sugar Corporation, and Provincial Farmers' Association (PFA) under the chairmanship of the JCRR representative. Through this campaign, more than 27 million rats were estimated to have been killed and some 135,000 metric tons of food are saved each year.

The present paper will report on the salient points of the experimentation, demonstration and island-wide campaign of field rat control in Taiwan and attempt to explain how the technical, organizational and administrative aspects of the program are coordinated to make the campaign a success.

II. A Study of Field Rat Control in Crop Fields

Early studies of field rat control using warfarin in sugarcane field were made by the Taiwan Sugar Corporation. The important findings were:

1. Selection of bait carriers for warfarin poison. Experiments made by the Taiwan Sugar Research Institute in 1952 showed that rice coated with 2% of peanut oil was most preferred by rats among 4 kinds of carriers used in the tests. Results of the similar tests conducted by the Pingtung Sugarcane Improvement Station in 1953 using 20 kinds of baits prepared with different materials and different proportions revealed that the largest daily consumption of bait was rice coated with peanut oil.

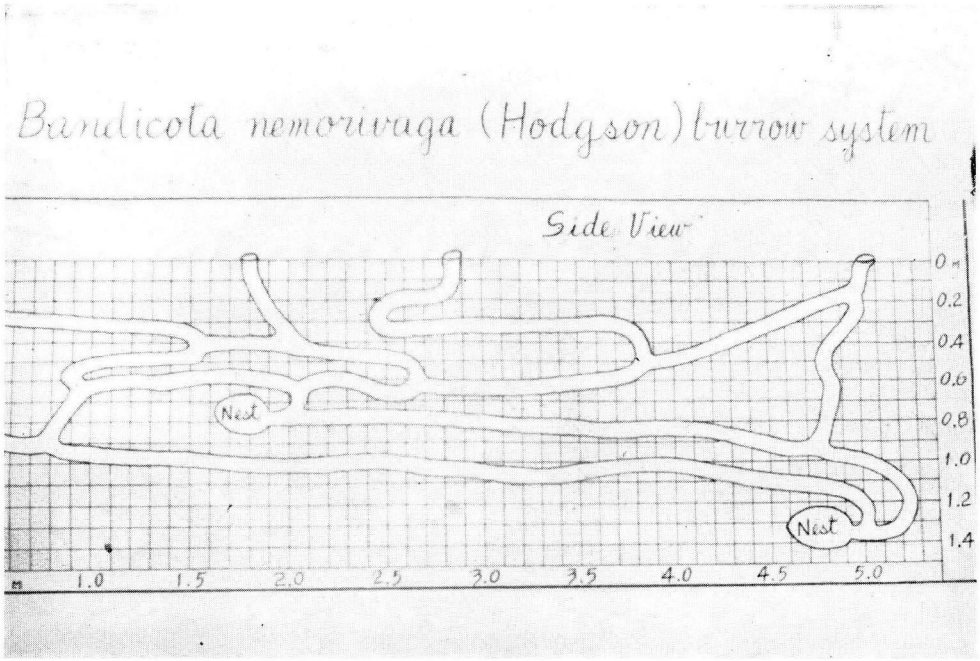
2. Tests on attractants. Attractants such as fried shrimp meal, fried peanut, fried fish, etc. mixed into the bait or put separately around the bait station showed no significant benefit in the field.

3. Baiting period. Cage tests showed field rat will be killed from 3 to 12 days after feeding with poisonous bait depending on the body weight and sex of rat. Field tests using 15 bait stations per ha. each contained 100 grams of poisonous bait and kept replenished to such a quantity of bait in the stations every day by re-filling indicated a minimum consumption on the 14th day after baiting (i.e. very few rat remained alive in the field). Extension of another 7-day baiting was recommended for ensuring highest kill.

4. Location of bait stations. Field rats prefer sheltered corners in the field mostly 3 to 4 feet behind the borderline of sugarcane plantation where due to border effect the crop was more vigorous, especially on borders along drainage. Yet bait stations at borders along roads or highways received least consumption of bait. Therefore bait stations should not be distributed evenly in the field.

5. Rat nests. Field rats usually build their nests in crop land several feet under the soil surface with tunnel connected between nests and with several

outlets. The following sketch shows rat holes built by Bandicota nemorivaga in sugarcane plantation.



In addition to information obtained by the Taiwan Sugar Research Institute from studies of rat control in sugarcane fields, a field experiment was initiated in June, 1955, whereby JCRR assisted the Taiwan Agricultural Research Institute and the Tainan District Agricultural Improvement Station to study the following: (1) to select the bait material preferred by rats in the fields of peanut, sweet potato and rice when Warfarin would be used as the poison; (2) to study the habit and activities of rats in these fields, and (3) to study the breeding season or seasons and life history of the rats both in the field and in laboratory cages.

The more important finding of the experiment, based on the final report submitted to JCRR by the Tainan District Agricultural Improvement Station are as follows:

A. Habits and activities of rats in crop fields: Observations were made in fields of different crops starting from September 1955 through June 1956, when baiting experiments were carried out at different townships.

1. *Kind of rats—in order of numerousness*

   a. Rice fields:
   Bandicota nemorivaga Hodgson
   Rattus losea Swinhoe

Mus formosanus Kuroda

b. Peanut fields:
Rattus losea S.
Bandicota nemorivaga H.

c. Sweet potato fields:
Rattus losea S.
Bandicota nemorivaga H.
Mus formosanus K.
Apodemus agrarius Pallas

2. *Extent of damage:*

a. Upland rice is more severely damaged by rats than paddy rice.

b. All crop fields neighboring sugarcane fields are more severely damaged than those farther away.

c. The fields close to cemetery, hillside, rolling land and waste land are more severely damaged.

d. For the same piece of land, the crops on the side next to sugarcane fields, water ditch, waste land, or other types of land where rats like to make dwellings are more severely damaged.

e. Sweet potato and peanut fields on the southern side of a sugarcane field are more severely damaged than those on the northern side.

f. Sweet potato and peanut fields with vigorous growth and thick vine coverage are more severely damaged.

g. Fields of sandy soil are more severely damaged than those of clayey soil.

h. Rat nests are rarely built around paddy fields, but mostly in the nearby sugarcane fields or grass waste land, and the rats go to the rice fields after darkness. Occasionally, *Mus formosanus* may form temperary dwellings and give birth to young ones in patches of lodged rice.

i. Upland rice, peanut and sweet potato fields are often invaded by rats which have nests in sugarcane fields and grass waste land. After the harvest of sugarcane, the rats in the cane field usually migrate to the upland rice, peanut or sweet potato fields and make temporary nests in those with better growth and thick leave of vine coverage.

3. *The mode of damage:*

a. Rice:

1) Nursery—Rats break the rice seedlings by biting near the soil surface or bite off the young leaf and damage the growing point. The rats also damage rice seedlings by stamping and forming rat path across the nursery.

2) Rice field—The rats nesting in sugarcane field, cemetery or elsewhere would invade rice field when rice begin to head, chew the rice stalk at from 15 to 20 cm. above ground, causing the stalk to break and bend over so that the newly formed kernels may be reached and eaten. Empty or half bitten rice hulls may often be found in small heaps along the foot path of the rice fields.

b. Peanuts:

Rats usually invade the peanut field at night. They would dig into the soil to reach the peanuts, bite through the hull and eat the kernel inside; or carry the whole peanut pod back to the nests and eat there. In severe cases, all the pods under a plant may be eaten. Sometimes the whole plant dies when the main roots are damaged by rats. Rats make holes in vigorously growing peanut fields for temporary dwelling, but never bore underground tunnels in peanut fields. Instead, they travel above ground over definite path which may be clearly seen, as the ground surface of their path is smoother and more compact.



Rat damage on peanut crop—digging up the nuts.

c. Sweet potato:

Rats would burrow down into the soil along the basal part of the plants and often bite on the side of the tuber, leaving ragged shallow holes and tooth marks. They may also bore a hole horizontally from the side of the bed to reach the potatoes. Sometimes they would bore underground tunnels of about 10 cm. in diameter with several outlets. Loose soil dug out of the tunnel may often be seen covering the outlets.



Rat damage on sweet potato.

B. Selection of baiting material:

1. *Method*—100 gm. of unpoisoned bait material placed in a number of containers were set out in the fields. Amount consumed from each bait station was measured daily by weighing.

a. Rice field:

1) Test-plot at An-nan township:

Testing period—September 13 to October 13, 1955.

Bait materials tested—Brown rice, partially crushed corn, rolled barley. The above three kinds of baiting materials are each mixed with three levels of peanut oil, 1.5%, 3% and 5%.

2) Test-plot at Hsin-kang township:

Testing period—Oct. 19 to 30, and again Nov. 7 to 18, 1955.

Bait materials tested—Brown rice, peanuts fried in deep oil, wheat flour dumplings fried in deep oil, peanut butter (1-2 gm. wrapped in paper),

and dried fish.

b. Peanut field—One test-plot at Shang-hwa township:

Testing period—Dec. 6 to 26, 1955.

Bait materials tested—Brown rice, peanuts, wheat flour dumplings fried in deep oil, peanut butter, dried fish, corn, rolled barley.

c. Sweet potato field—One test-plot each at Shang-hwa and Liu-chiao townships:

Testing period—April 10 to 21, 1956.

Bait materials tested—Brown rice, peanut, wheat flour dumplings fried in deep oil, dried fish, fresh sweet potato.

2. *Summary result:*

a. Rice field—When brown rice, corn and barley were compared, the bait material consumed by rats in the largest amount was corn, followed in order by brown rice and rolled barley. In the other test-plot where comparison was made among brown rice, peanut, peanut butter, dried fish, etc. peanut was consumed by rats in the largest amount, seconded by brown rice. Very little of other bait materials were consumed by rats.

b. Peanut and sweet potato fields—Peanut first, brown rice second. Other bait materials were taken by rats only in small amounts.

C. Experiment on poisonous baits containing Warfarin

1. *Method:*

a. Rice field—15 bait stations were set up per hectare, filled with non-poisonous baits (brown rice, to which was added 1.5% peanut oil) for 15 days as attractant; then switched to poisonous baits (to the above baits, add 1/20 by weight of 0.5% warfarin). Amount of bait consumed was measured each day, and replaced with fresh bait.

An-nan test-plot—Sept. 13 to Oct. 13, 1955

Hsin-kang test-plot—Sept. 30 to Oct. 30, 1955

b. Peanut field—Test-plots were laid out in three townships; peanut fields next to sugarcane field were chosen. Bait stations were filled with non-poisonous bait for 10 days, then changed to poisonous baits.

Shang-hwa test-plot—Dec. 6 to 26, 1955

Liu-chiao test plot—Nov. 21 to Dec. 17, 1955

Tai-pao test-plot—Dec. 29, 1955 to Jan, 18, 1956

c. Sweet potato field—Test-plots were laid out in three townships. Bait stations were filled with non-poisonous bait until the daily consumption became more or less constant, then, changed to poisonous bait.

Shang-hwa test plots:

Plot 1—April 10 to May 1, 1956

Plot 2—April 20 to May 15, 1956

Liu-chiao test plot: April 11 to May 18, 1956

Tainan test plot: May 31 to June 28, 1956

2. *Summary result:*

a. Rice field—Using the non-poisonous bait, the amount of bait taken up by rats began to increase 4 to 10 days after baiting started. When switched to poisonous bait by adding warfarin, the amount taken by rats began to decrease after 4 to 8 days; and the consumption of bait stopped completely after 14 to 15 days.

b. Peanut field—

1) Peanut field not neighboring sugarcane field—Amount of non-poisonous bait taken up by rats increased rapidly after the 3rd day of baiting. When switched to poisonous bait, the bait consumption began to decrease after 3 to 4 days and stopped completely after 8 to 10 days.

2) Peanut field next to sugarcane—The consumption of non-poisonous baits showed erratic changes from day to day. After switched to poisonous bait, the bait consumption began to decrease gradually and stopped completely after 10 days.

c. Sweet potato field—The consumption of the non-poisonous baits showed steady increase at the Liu-chiao and Tainan test plots, but not at the Shang-hwa test plot. The consumption of the poisonous baits began to decrease after the 3rd day of baiting. It showed increase once more after heavy rain ruined the old baits. However, the consumption gradually decreased again after fresh baits were added to replace the old one.

D. General conclusions:

1. Among the major crops besides rice, sweet potato and peanuts are most seriously damaged by field rats. According to survey made in the present experiment, the rat damage to sweet potato averaged 9 percent of the yield, with a maximum of 17 percent; that to peanut averaged 5-6 percent, with a maximum of 22 percent.

2. Among the bait materials tested, the rats favored peanuts the most, and brown rice the next. But for the sake of economy and ease to work with,

a bait made of brown rice mixed with a proper amount of peanut oil seems to be most adequate.

3. The number of bait stations needed for each hectare of land varies with the density of the rat population. Careful survey should be made of the field to locate the rat holes and the rat tracks, so as to determine where best to set up the bait stations. They should be set up along the rat tracks.

4. Number of days needed for baiting—3 weeks.

5. To obtain effective results, the baiting must not be done on scattered fields, but on area-wide basis. To choose the season of baiting is also important. Rainy season should be avoided.

III. The Demonstration of Field Rat Control Method in 14 Townships

Based on the experimental results outlined above, a demonstration project was planned jointly by the Provincial Department of Agriculture and Forestry, Provincial Food Bureau and JCRR. The total budget for the demonstration project was NT$ 877,077, of which NT$ 150,000, NT$ 502,500, NT$25,000 and NT$ 199,577 were contributed by PDAF, PFB, Hsinchu Prefectural Government and JCRR respectively. The working plan and the result obtained may be briefly reported as follows:

A. The plan

1. *The demonstration townships:*

The demonstration was carried out on township basis in the following townships selected by the prefectural governments concerned.:

Taipei Prefecture	—	Shulin Township
Yilan Prefecture	—	Touchen Township
Taoyuan Prefecture	—	Taoyuan Township
Hsinchu Prefecture	—	Hsinchu City (Suburban area)
Miaoli Prefecture	—	Kungkwan Township
Taichung Prefecture	—	Taya Township
Changhua Prefecture	—	Pushin Township
Nantou Prefecture	—	Tsaotun Township
Yunlin Prefecture	—	Tounan and Hsilo Townships
Chiayi Prefecture	—	Taipao Township
Tainan Prefecture	—	Yutsing Township
Kaohsiung Prefecture	—	Meeto Township

Pingtung Prefecture — Chutien Township

The distibution of the demonstration townships is shown in figure 1. (a map) on page 3.

2. *Time of baiting*:

a. Baiting should be done at the time when natural food available in the field to rats is the least, i.e. the season when crops occupy the smallest acreage. Rats would migrate away from harvested fields and concentrate in those with standing crops. Thus baiting may be done efficiently over a smaller area. Bait, bait stations and labor may be greatly economized.

b. Select seasons usually with favorable weather conditon for field baititing. Avoid rainy season for bait will mold and rot quickly after wetting.

Based on the above principles, the best baiting period for most areas in Taiwan is the winter season after the harvest of the second rice crop. In Central and South Taiwan, winter is a dry season. The baiting period for each township is about 3 weeks, a period sufficiently long for all field rats in the area to have a chance to take a fatal amount of poisonous bait from the bait stations.

3. *Area of baiting*:

The winter crop area of each of the demonstration townships was carefully determined by the township office by interviewing each farm family. Based on the area of the winter crop, the waste land, cemeteries, irrigation canals and ditches, the township office decided on the baiting acreage. The baiting acreage in the demonstration townships varied from 577 ha. in Meeto township to 4,104 ha. in Tsaotun township. The average is about 2,300 ha. per township.

Demonstration township	Cultivated land area (ha.)	Baiting acreage (ha.)
Touchen	3,207	1,710
Shulin	1,800	1,653
Taoyuan	2,453	2,405
Hsinchu	2,550	2,686
Kungkwan	4,530	2,819
Taya	2,610	1,928
Tsaotun	10,220	4,104
Pushin	1,669	1,851.1
Hsilo	3,550	3,576
Tounan	3,800	3,800

Demonstration township	Cultivated land area (ha.)	Baiting acreage (ha.)
Taipao	5,164	2,981
Yutsing	2,625	1,213
Meeto	546	577
Chutien	2,292	1,983
Total:	47,016	33,286.1

Rodents also migrate from field to rural houses at the close of the crop season searching for food, and vice versa, in the spring when food is more abundant in the field. Paddy warehouses and farmers' houses in village of the 14 demonstration townships therefore were included in the baiting. The towns of the townships with population of over 10,000, however, were not included in the baiting.

4. *Bait and bait stations:*

Poisonous bait of ingredients at the following proportion by weight was used:

Brown rice	9.50
Peanut oil	0.19
0.5% warfarin	0.50

The bait was mixed by the township office/township farmers' association and distributed to farmers. Automatic feeding and moisture-proof bait stations made of bamboo were made by the township office according to standard design and distributed to farmers for use.

All rural houses in villages, including farmers' seed storage houses, etc. were baited. 0.12 kg. of poisonous bait was given to each house (i.e. if a family has 4 separate units of house, it will receive o.48 kg.). Cropped field received 5 kg. per hectare; and public land 4 kg. per hectare. Each hectare of baiting area would bear 10 bait stations. The amount of poisonous bait and bait stations used by the demonstration townships are as follows:

Township	Poisonous bait used (kg.)	Number of bait stations used
Touchen	8,075	17,100
Shulin	6,381	16,530
Taoyuan	11,700	24,050
Hsinchu	14,533	26,860

Township	Poisonous bait used (kg.)	Number of bait stations used
Kungkwan	13,441	28,190
Taya	7,994	19,280
Tsaotun	19,823	41,040
Pushin	9,124	18,510
Hsilo	18,636	35,760
Tounan	10,311	38,000
Taipao	15,859	29,810
Yutsing	6,518	12,130
Meeto	5,000	5,770
Chutien	9,800	19,830
Total:	157,195	332,860

5. *Organization of township field rat control team:*

The project involves a great deal of work in its planning as well as operation and evaluation of result. It needs all out cooperation of all local agencies concerned, e.g. prefectural governments and farmers' associations (FAs), township public offices (POs) and farmers' associations, Taiwan Sugar Corporation mills, etc. Every prefectural government should work closely with the selected townships so that prefecture specialist could become thoroughly acquainted with the technique and be truly able to assist the township technically. The organization responsible for conducting the demonstration work was as follows:

a. Each demonstration township organized a field rat control team to undertake all the technical and administrative matters concerning the project.

b. Township chief headed the control team, and the general manager of the township farmers' association served as the deputy leader of the team.

c. Attached to the township control team were 2 sections, the administrative section and the technical section, heads of which were both appointed from officials of the township public office or the farmers' association.

d. Under the township control team, several sub-teams were organized, one each in a village, and each with a sub-team leader and a supervisor appointed from township public office and farmers' association officials.

e. Each sub-team was sub-divided into small working units, leaders and assistants of which were appointed by village chiefs or small agricultural unit chiefs of the township. They worked directly with farmers or by organizing

them into still smaller groups for carrying out the necessary work.

6. *The principal works done by township field rat control team:*

a. Surveying and determining baiting acreage, including those of cropped field (on per family, village and township basis), public land, waste land, grave-yard, irrigation ditches, etc.

b. Estimating requirement of poisonous bait and number of bait stations.

c. Sponsoring training classes on control technique and discussion meetings, dissemination of publicity materials, and conducting farmers education.

d. Preparation of poisonous bait and bait stations and distribution of the same.

e. Advising on the proper location of setting bait stations and filling and renewing bait.

f. Collection of rat tail.

g. Compilation of data and reporting.

B. The budget

Item	Quantity	Item cost (NT$)	Remark
Warfarin	8,680 kg.	—	Provided by JCRR in kind.
Bait Stations	347,190 pcs.	476,985	Subsidized by JCRR, PDAF, PFB etc. and distributed to farmers free of charge.
Brown rice	137,815 kg.	353,367	〃
Peanut oil		34,800	〃
Subsidy for bait mixing		5,800	Subsidized by JCRR, PDAF and PFB.
Total		870,952	

Source of funds:

PDAF	NT$ 150,000
PFB	502,500
JCRR	199,577
Hsinchu Prefectural Government	25,000
Total:	NT$ 877,077

C. Result of the demonstration

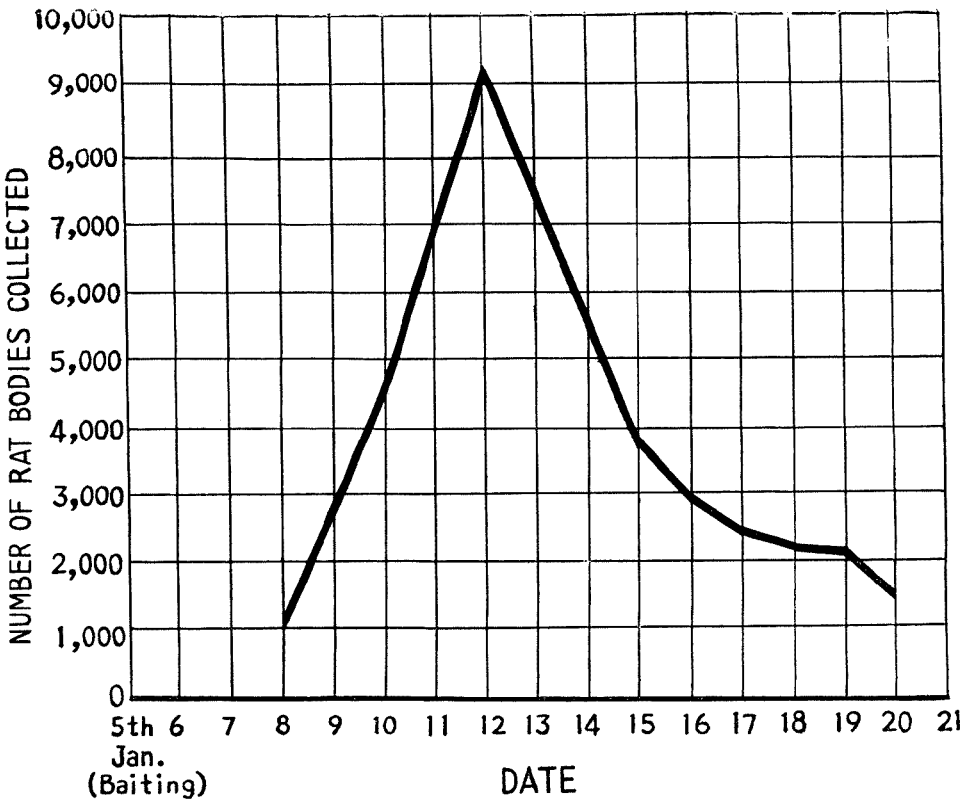
1. *Total number of field rat killed:*

Township	Farm families	Baiting acreage (ha.)	Poisonous bait used (kg.)	Rat tails collected (pc.)	Estimated number of rat killed (head)
Touchen	4,327	1,710	8,075	34,350	103,050 — 137,400
Shulin	1,667	1,653	6,381	43,515	130,545 — 174,060
Taoyuan	2,055	2,405	11,700	44,752	134,256 — 179,008
Hsinchu	2,896	2,686	14,533	81,747	245,241 — 326,988
Kungkwan	5,012	2,819	13,441	24,146	72,438 — 96,548
Taya	3,129	1,928	7,994	30,677	92,031 — 122,708
Tsaotun	8,191	4,104	19,823	97,885	293,655 — 391,540
Pushin	4,049	1,851.10	9,124	62,972	188,916 — 251,888
Hsilo	4,477	3,576	18,636	57,510	172,530 — 230,040
Tounan	5,480	3,800	10,311	46,788	140,364 — 187,152
Taipao	3,222	2,981	15,859	56,876	170,628 — 227,504
Yutsing	2,555	1,213	6,518	31,777	95,331 — 127,108
Meeto	2,600	577	5,000	9,680	29,040 — 38,720
Chutien	2,199	1,983	9,800	73,957	221,871 — 295,828
Total	51,859	33,286.10	157,195	696,632	2,089,896 — 2,786,492
Average per township	—	—	—	49,758	149,000 — 199,000
Average per hectare	—	—	4.72	21	63 — 84

Note: (1) This table was compiled by PDAF according to reports submitted by all demonstration township public offices.
(2) Estimated number of rat killed is calculated by multiplying the number of rat tails collected by 3 or 4.

2. *Percentage of kill:*

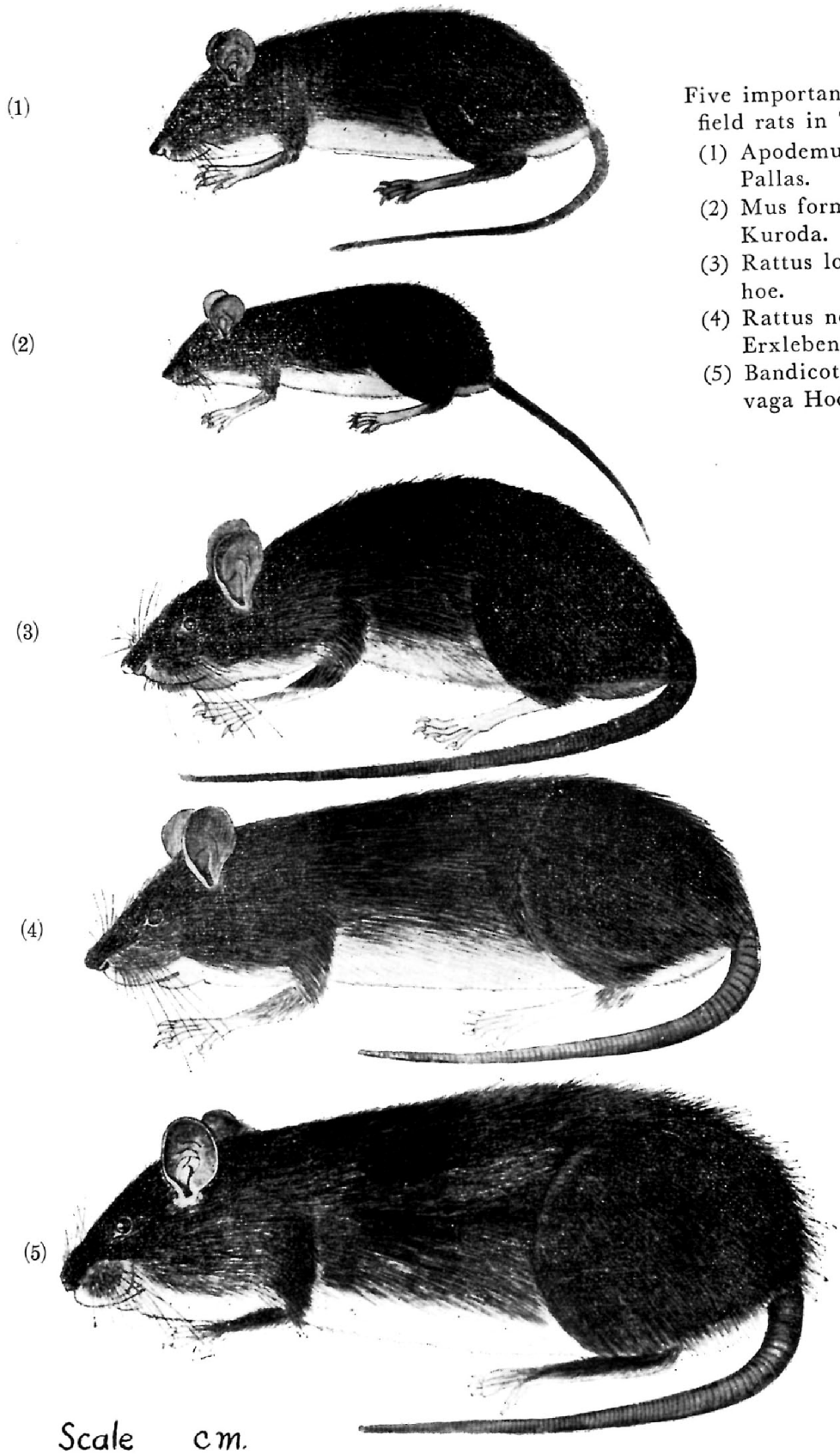
The following curve shows the number of dead bodies of rats collected day by day in Taipao Township, Chiayi Prefecture during the 13 days of the baiting period. It indicates that the maximum kill occured on the 7th day after baiting, the number then dropped steadily to a very small number of kill after about 2 weeks. Interpreting that, after 3 weeks of normal baiting period, very few rats remained alive in the field, ideal reault seems to have been reached.



3. *Analysis of different species of field rat killed in the program:*

During the baiting, one township, Pushin township of Changhua Prefecture was designated to make analysis on species of field rat killed. Rat carcasses were collected, preserved temporarily in formalin solution, identified and counted by species. The following table shows the result of analysis:

Species of field rat	Number of head	%
Bandicota nemorivaga Hodgson	5,394	37.88
Rattus losea Swinhoe	3,008	21.12
Mus formosanus Kuroda	2,759	19.38
Rattus norvegicus Erxleben	1,482	10.41
Apodemus agrarius Pallas	1,349	9.47
Others	248	1.74
Sub-total:	14,240	100.00
Unidentifiable carcasses	2,987	
Total:	17,227	



Five important species of field rats in Taiwan.

(1) Apodemus agrarius Pallas.
(2) Mus formosanus Kuroda.
(3) Rattus losea Swinhoe.
(4) Rattus norvegicus Erxleben.
(5) Bandicota nemorivaga Hodgson.

IV. The Island-wide Field Rat Mass Extermination Campaign

A. Objective and Scope:

The rat damage is increasing each year. Extermination of field rat not only is an unanimous request of all farmers, but also is one of the most effective means for further increasing food production in Taiwan. 304 townships out of a total of 360 participated in the field rat control campaign (2 townships in Penghu Hsien did not join the campaign because of its financial stringency to provide fund). All the crop fields, waste land, dikes, graveyards in each of the participating townships were covered. All the families in the villages were included regardless whether they were farmers or not. However, towns or communities with a population of over 10,000 are not included as they would present other problems. The total acreage covered in this campaign is about 817,835 hectares (total cultivated land area of Taiwan, about 875,000 hectares), and baiting acreage is 411,618 hectares. The total number of farm families involved is 817,540.

The gist of the program is to educate, organize, and mobilize all the farmers to use poisonous bait made mainly by mixing brown rice with Warfarin in the field during a designated period of time according to given methods as stated in previous sections.

B. The Organization of the Campaign:

Organization of the campaign is the most important preparatory work towards the implementation of this island-wide program. It was started as early as in January, 1957, although the actual field baiting was scheduled for the winter of 1957/1958. The ultimate aim of the organization is to mobilize all farmers to do the baiting strictly in accordance with the established plan.

It should be noted that the organization of the township field rat control team is the most basic one among all levels. The organization of township field rat control teams in the 14 townships which did demonstration work in winter of 1956/57 served as a blue print for the same in all townships under the present island-wide campaign. It was our conviction that the soundness of these basic units would insure the final success of the entire campaign; which relied on the accurate estimation of the townships' baiting area, timely distribution of baits and bait stations, and the full mobilization of all farmers to set out bait stations at proper places and at designated time, to re-fill the bait stations periodically with fresh baits, and finally to look for the rat carcasses

Organizational Chart of the Taiwan Field Rat Control Campaign

The Provincial Committee

Members	Technical advisors	Supervisors (21 persons)	Functions
Joint Commission on Rural Reconstruction (JCRR)—Convener. Provincial Department of Agriculture and Forestry (PDAF)—Chief Executing Agency. Provincial Food Bureau (PFB) Provincial Farmers' Association (PFA) Taiwan Sugar Corporation (TSC)	Taiwan Sugar Corporation. Taiwan Agricultural Research Institute.	PDAF PFB	(1) Planning of entire campaign. (2) Budgeting and providing program funds for assisting prefectures. (3) Deciding on baiting acreage and farm families. (4) Supply and distribution of Warfarin, brown rice, peanut oil, sugar, salt to townships. (5) Technical training, printing of educational materials, publicity. (6) Supervision

Prefectural /City Committee

Members	Supervisors	Functions
Prefecture/City Government—Executing Agency. Prefecture/City Farmers' Association. Sugar Mill of the Taiwan Sugar Corporation. District Agricultural Improvement Station. Branch Office of Provincial Food Bureau.	Prefecture/City Government. Prefecture/City Farmers' Association.	(1) Planning of prefecture campaign. (2) Budgeting, providing budget funds in addition to provincial subsidy and assisting townships to raise fund. (3) Screening of baiting acreage and farm families of the townships. (4) Technical training for township personnel. (5) Education, supervision, & publicity. (6) Overseeing the preparation of bait and bait stations for townships. (7) Compilation of data and reporting.

Township Committee

Members	Supervisors	Functions
Township Public Office (Township Chief acts as team leader.) Township Farmers' Association (FA Gen. Manager as team assistant). Sub-team leaders (village chiefs.) Farmers.	Township Office. Township Farmers' Association.	(1) Planning of township campaign. (2) Survey of baiting acreage and farm families. Supply and distribution of bait stations. (3) Mixing and distribution of bait. (4) Technical training of farmers. (5) Supervision over baiting. (6) Rat tails collection and dead rats disposal. (7) Compilation of data and reporting.

and collect the rat tails.

C. The Working Schedule:

Such full mobilization of farmers called for careful planning, thorough implementation of each function, close supervision and fullest coordination of all agencies concerned. It took almost nine-month time for the preparatory work to be completed.



Provincial field rat control conference prior to the campaign.

The following working schedule will illustrate how the organization functions:

CY	Month	Progress of work
1956	December	1) Register the townships willing to participate in the island-wide campaign.
		2) Compile data on the total crop acreage and farm families of all participating townships as basic reference for program planning.
1957	January	Ditto.
	February	Preliminary estimate of farm families and baiting acreage on township, prefectural and provincial basis.

March	1) Observe and hold discussion meeting on the result of demonstration project of field rat control conducted in winter of 1956/57.
	2) Drafting of plan for island-wide campaign, 1957/58.
April	1) First meeting of the Provincial Field Rat Control Committee to discuss the drafted plan.
	2) Prepare educational pamphlet.
	3) Hold technical trainning classes for supervisors to be sent out by the Provincial Committee and the responsible personnel of all prefectural governments.
	4) Prepare prefectural level conferences for township personnel for discussion of the respective prefectural plans.
	5) Start planning the supply of Warfarin, brown rice, peanut oil, etc.
	6) Continue the drafting of the educational pamphlet.
May	1) Complete draft of pamphlet.
	2) Issue a public letter to farmers in general regarding island-wide campaign.
	3) Assist the prefectural governments in organizing prefectural committees.
	4) Prefectural level discussion conferences and technical training classes for township personnel.
	5) With reference to preliminary estimates made in February, ascertain by actual surveying crop acreage and farm families in all villages by township public offices.
June	1) Complete surveys on crop acreage and farm families in all villages.
	2) Compile and study the result of the surveys.
	3) Start publicity campaign at village assembly meetings. PDAF's mobile units despatched to villages to assist extension on control technique and the importance of the campaign.
	4) Start drafting township plans for field rat control campaign.
	5) Prefectural meetings of township personnel to review work progress. (Supervisors attended)
July	1) Complete the drafting of all townships working plan, and submit to prefectural government for screening.
	2) Continue farmers' education.
	3) Prepare funds for township campaign.

		4) Prepare bait stations.
		5) Prefectural conferences of township personnel for reviewing work progress.
		6) Provincial conference of prefectural personnel for reviewing work progress.
	August	1) Complete the making of bait stations.
		2) Allocation of warfarin and remittance of subsidy to townships of prefectures where the field baiting starts early.
		3) Township meeting for reviewing all preparatory works and enforcing farmers education.
		4) Supervisors inspect bait stations in all townships.
		5) Prefectural conferences for reviewing work progress in all its townships.
	September	1) Purchase of brown rice by townships.
		2) Purchase of peanut oil by townships.
		3) Continue education of farmers.
		4) Prefectural conferences.
		5) Provincial conference.
	October	1) Distribute bait stations to all villages by township offices.
		2) Complete preparation of bait material and the poison.
		3) Bait mixing in townships.
	November-	1) Review and check all preparatory works.
)58	March	2) Distribution of poisonous bait.
		3) Baiting in field (3 weeks).
		4) Rat tails collection.
		5) Inspect number of rat tails collected in each township by supervisors.
	April	1) Prefectural conferences to review the result of campaign in every township.
		2) Payment of rat tails.
	May	1) Provincial conference for evaluating outcome of the campaign.
		2) Award prizes to prefectures and townships having done best job in campaign.

D. Method and Material:

The method used in the campaign is essentially the same as in the demonstration project carried out in the winter of 1956/57 in 14 townships:

1. *Survey of baiting acreage:*

Each township undertook the survey of winter crop area, the waste land, graveyard, irrigation ditches, dikes, etc. which in total form the baiting acreage and the farm families involved, all on village basis. The survey was done according to a table form and a surveying procedure prepared by the Provincial Committee and channeled to the townships through the Prefectural Committees. The village data were compiled to give townships and then prefectural statistics. Based on the data of baiting acreage and farm families, the material for making bait and bait stations were bought and prepared.

2. *Bait and bait stations:*

The main materials for making the bait were warfarin, brown rice and peanut oil, mixed in the same proportion by weight as in the demonstration. These materials were made available to the program by the following means:

a. 0.5% warfarin—10% warfarin was imported through the US Aid Commodity Program, bought with funds contributed by the Provincial Department of Agriculture and Forestry and the Provincial Food Bureau, processed into 0.5% warfarin by the mixing plant of the Taiwan Sugar Corporation, and distributed to townships free of charge.

b. Brown rice—was provided by farmers themselves or loaned or purchased from the Provincial Food Bureau.

c. Peanut oil—was purchased by the townships from the Taiwan Supply Board, and paid by farmers. Arrangement for the purchase was made by the Provincial Department of Agriculture and Forestry on behalf of the Provincial Committee.

d. Bait stations—were made or bought by farmers themselves. The Taiwan Sugar Corporation's farms provided their own bait stations. Farmers or townships might have free choice of the type of bait stations; e.g. those made of bamboo or cement. Farmers also might use improvised bait stations made simply by placing one piece of curved earthern roof tile over another, or other suitable materials.



Processing of warfarin in the Taichung Sugar Mill.



Distribution of processed warfarin from the Taichung Sugar Mill to townships.



Various kinds of bait stations used in the campaign.



Making of bait station by a farmer.

The poisonous bait was mixed and prepared by the township committee and distributed to farmers through the village sub-teams at a rate of 4 kg. of bait per hectare of baiting acreage and 1 kg. per household. The baiting acreage, farm families, various material for making the bait and bait stations used in the campaign are given in the following table:

Prefecture/ Municipality	No. of town-ships	Partici-* pating farm families	Baiting acreage	Materials required			
				Bait station	Brown rice	Peanut oil	0.5% warfarin
			(ha.)	(pcs.)	(kg.)	(kg.)	(kg.)
Taipei P.	15	19,939	10,767.40	114,720	59,835.65	1,306.72	3,165
Yilan P.	10	29,119	10,056.60	100,291	42,302.00	919.30	3,495
Keelung M.	7	1,169	716.00	8,030	4,120.15	89.44	240
Taipei M.	6	2,873	1,045.00	10,000	6,823.00	143.58	360
Yangmingshan Adm.	2	2,481	1,427.00	13,993	8,835.85	181.12	510
Taoyuan P.	13	36,202	19,000.00	190,000	106,576.32	2,243.22	5,625
Hsinchu P.	15	29,789	11,900.00	119,269	72,566.70	1,466.17	3,825
Miaoli P.	18	49,764	20,860.24	186,488	101,781.95	2,181.45	5,340
Taichung P.	21	54,729	21,210.00	260,064	125,435.00	3,288.90	6,615
Taichung M.	7	16,186	6,938.89	76,820	27,915.00	574.26	1,455
Nantou P.	11	45,747	16,826.00	159,089	87,705.75	1,755.28	4,755
Changhua P.	26	101,976	68,789.00	452,099	204,869.00	4,352.00	10,832
Yunlin P.	20	84,139	44,985.21	696,256	247,013.40	5,220.91	12,915
Chiayi P.	19	68,254	27,695.98	278,043	166,098.00	3,594.00	9,090
Tainan P.	31	93,563	47,311.29	724,343	248,731.64	5,042.44	14,505
Kaohsiung P.	25	70,639	17,071.90	197,506	130,809.25	2,786.70	6,945
Tainan M.	5	21,731	8,788.00	90,030	31,958.05	786.48	2,235
Kaohsiung M.	8	8,355	1,388.00	12,944	11,300.00	243.00	600
Pingtung P.	33	59,672	25,108.00	251,050	152,099.00	3,802.00	8,345
Taitung P.	6	11,397	6,987.00	79,125	57,520.25	789.90	1,980
Hualien P.	6	9,816	7,232.00	108,480	36,806.80	832.04	1,935
TSC farms	—	—	35,514.52	53,272	101,000.00	2,021.00	5,315.83
Total:	304	817,540	411,618.03	4,181,942	2,032,102.76	43,618.91	110,082.83

*Including all families living in areas covered by baiting, they may be farmers, fishermen or other non-farming families living in rural areas.

3. *Supervision and education:*

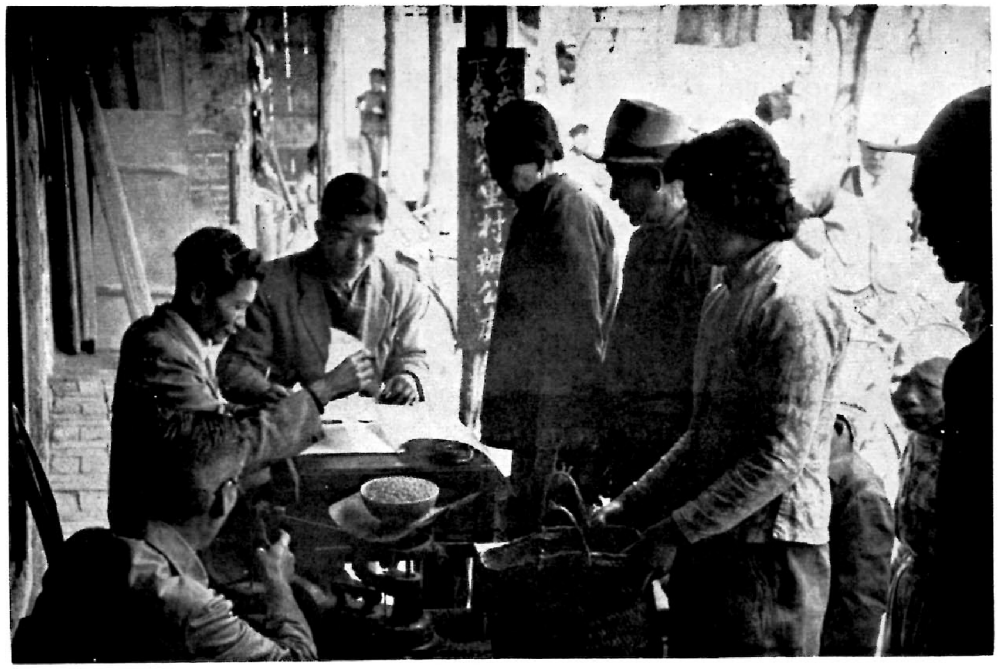
a. Supervision:

The Provincial Committee sent out 21 supervisors, 16 recruited from the Provincial Department of Agriculture and Forestry and 5 from the Provincial Food Bureau. Each supervisor was assigned to an area wherein he would work constantly with the Prefectural Committee and travel among the townships to see that all preparatory work mentioned in above sections were carried out properly and on schedule. The 21 supervisors met periodically at meetings called by the Provincial Department of Agriculture and Forestry to report on work progress in their respective areas, discussed problems encountered and suggested changes needed to be made or new actions needed to be taken.



Mixing of poisonous bait in Farmers' Association.

The staff members of the agricultural section of the prefectural governments and the extension section of the prefectural farmers' associations formed the supervisors at the township level. They worked closely with supervisor sent by the Provincial Committee. The agricultural staff of the township public offices and the township farmers' associations were the front-line workers in this campaign. They actually did the work of survey, education, preparation and distribution of bait and bait stations, and oversaw the collection of rat tails. All basic statistics came from these men; though in



Distribution of bait to farmers.



Distribution of bait stations to farmers.

carrying out the field work, they were helped by the village sub-team leaders who were either village chiefs or the chiefs of the Small Agricultural Unit of the farmers' association.

b. Education:

The educational work of this program was more thoroughly and widely carried out than most other agricultural program, with the only exception of perhaps the Land Reform Program. All farmers in all participating 304 townships were well informed on the importance of the program.

In the first place, the township supervisors went to the door of each farm family to find out its winter crop area and each village chief must in addition provide information on the area of waste land, graveyard, irrigation ditches, etc. which were all a part of the baiting area. In carrying out such surveys, the meaning of the program and the method of rat control were explained to them. Since the rat damage has been a serious problem to all farmers, it is a subject they were all interested in knowing and learning. The distribution of bait gave another opportunity for the supervisors to actually reach each village and contact all farm families. Such direct meeting with farmers provided the best opportunity for person to group education.

Besides, the regular types of the educational media were also widely employed. The following educational materials were prepared and distributed by the Provincial Committee:

a) Extension pamphlet, 100,000 copies.

b) Posters, 5 kinds, each 10,000 copies.

c) A public letter to farmers announcing the program, 200,000 copies.

d) Lantern slide, 3 slides per set, 330 sets.

e) Film strip, 22 pictures per strip, 27 sets.

f) Leaflet, 50,000 copies.

g) Field manual on rat control campaign for all levels of supervisors, 1,500 copies.

h) Special issue on Rat Control Campaign by the monthly Farmers' Magazine of the Provincial Farmers' Association.

i) A movie is being made of the work progress of the campaign.

Educational and publicity work were conducted through the following means:

a) Explain the campaign and control methods and discuss with far-

mers at the regular monthly government sponsored "Village Assembly Meetings".

b) Show lantern slides and slogans for rat control campaign at movie theaters or other large gatherings of people.

c) Hold "Rat Control Campaign Publicity Week" during which posters are widely posted and leaflets distributed.

d) Two agricultural educational mobile units (motor vehicle) of the Provincial Department of Agriculture and Forestry travelled all over the province for nearly 9 months to do publicity and educational work on the rat control campaign.

e) Hold conferences and training classes at all levels on method of rat control.

f) Hold field demonstrations on how and where to set the bait stations.

g) Frequent news release to newspapers on the progress of the campaign.

h) Radio broadcasts.

i) Direct contact of the supervisors with village leaders and farmers.



Township supervisor instructing farmer to place bait properly in the field.



Publicity made by township field rat control team.



Farmers training class held in village.

4. Time schedule for field baiting:

The time schedule for actually carrying out the field baiting in different prefectures are shown as follows:

Prefecture/ Municipality	Baiting Period
Yilan P.	Jan. 6, 1958—Feb. 15, 1958
Keelung M.	Dec. 3, 1957—Jan. 5, 1958
Taipei M.	Jan. 6, 1958—Feb. 15, 1958
Yangmingshan Adm.	Jan. 6, 1958—Feb. 15, 1958
Taipei P.	Jan. 6, 1958—Feb. 28, 1958
Taoyuan P.	Dec. 7, 1957—Jan. 15, 1958
Hsinchu P.	Jan. 22, 1958—Mar. 10, 1958
Miaoli P.	Dec. 1, 1957—Jan. 10, 1958
Taichung P.	Dec. 9, 1957—Jan. 15, 1958
Nantou P.	Dec. 5, 1957—Jan. 20, 1958
Changhua P.	Sept. 25, 1957—Oct. 31, 1957
Taichung M.	Dec. 4, 1957—Jan. 15, 1958
Yunlin P.	Dec. 1, 1957—Jan. 20, 1958
Chiayi P.	Jan. 10, 1958—Feb. 25, 1958
Tainan P.	Feb. 1, 1958—Mar. 25, 1958
Tainan M.	Dec. 1, 1957—Jan. 31, 1958
Kaohsiung P.	Jan. 10, 1998—Feb. 25, 1958
Kaohsiung M.	Jan. 10, 1958—Feb. 25, 1958
Pingtung P.	Nov. 21, 1957—Feb. 25, 1958
Taitung P.	Dec. 1, 1957—Jan. 10, 1958
Hualien P.	Dec. 1, 1957—Jan. 20. 1958

It is to be noted from the above table that only in Changhua Prefecture the baiting was started in late September and completed in October. In all other prefectures and municipalities, the baiting was not started until November 21; most of them in December and January; and one as late as February. The early completion of baiting in Changhua Prefecture was due to the fact that the winter cropping area in that prefecture occupied a majority of the rice field so that the harvest of the second rice crop did not make the cropped area in the winter any smaller. Instead, the smallest baiting acreage there would be when the rice fields were still flooded and rats holed up mostly in dry land and travelled only along the foot path of the rice fields. In all other prefectures and municipalities, the winter cropping acreage oc-



Baiting in wheat field.



Baiting in graveyard.



Baiting in farm house.

cupied only a small part of the rice land. The baiting was therefore done after the harvest of the second rice crop. From late November to February, the different prefectures and municipalities might choose the period to suit their own convenience.

5. Collection of rat tails:

Rat tails were collected to provide a criterion for appraising the successfulness of the baiting in different townships and prefectures. The public exhibition of the rat tails collected also gave the program effective publicity which could help impress on people both in the urban and rural areas the numerousness of rats and the extent of damage they could do, so that farmers might continue to practise the rat control in the future by themselves.

The farmers were encouraged to find the rat carcasses in the field and house, cut the tip portion off, mix with lime powder and dry them, and submit them to village sub-team leaders who would collect the rat tails submitted by farmers of his village and send them on to the township public office, where the tails were further dried, counted and placed in plastic bag each containing 1,000 dried tails. In order to encourage the collection of tails, farmers were given NT$0.10 for each tail submitted. The nnmber of tails collected by each

village (or township, or prefecture) multiplied by 3 or 4 was taken as the total number of rats killed in that village (or township, or prefecture) since it is estimated that only 1 out of 3 or 4 dead rats is readily found, the others would die in holes or among the thicks of the crops or in water ditches where they



Rat tails collection in township.



Burying of dead rats underground.

are not easily found. They, however, rot and give very bad smell over the field. From the smell, farmers claim that the dead rats not found must be more than 3 or 4 to each rat body found.

After the collection of rat tail was completed, the township would send all the tails, 1,000 in a plastic bag, to the prefectural government or prefectural farmers' association for public exhibition.

Each township office kept a record of rat tails collected each day after the baiting was started until no more tails were submitted. A graph was made to show the daily collection record and the total number of tails collected. The township graphs were exhibited along with their respective tail collections at the prefecture after the completion of the baiting.

E. The Budget:

1. Item breakdown:

Item	Quantity	To be borne by JCRR & Provincial Agencies	To be borne by local agencies and farmers
		(NT$)	(NT$)
0.5% warfarin	112,685 kg.	1,332,277	—
Brown rice	2,141,255 kg.	—	5,995,514
Peanut oil	42,869 kg.	—	514,752
Bait station	3,690,360 pcs.	—	7,380,720
Bait mixing		41,411	—
Transportation		29,400	—
Pamphlet and other printing		100,000	—
Extension materials and others		110,000	—
Subsidy to townships		2,970,000	—
Travelling for supervision and inspection		150,000	—
Training classes		5,000	—
Miscellaneous		39,000	—
Rat tail collection		1,000,000	—
Subsity for prefectural governments		30,400	—
Reserved fund for subsidy to townships		30,000	—
Sub-total:		5,837,488	13,890,986
Grand total:		NT$19,728,474	

2. *Sources of project fund:*

	FY 1957 (NT$)	FY 1958 (NT$)	Total (NT$)
Joint Commission on Rural Reconstruction	1,200,000	2,972,488	4,172,488
Provincial Department of Agriculture and Forestry	5,000	300,000	305,000
Provincial Food Bureau	350,000	700,000	1,050,000
Taiwan Sugar Corporation	—	300,000	300,000
Provincial Farmers' Association	10,000	—	10,000
Total:	NT$1,565,000	NT$4,272,488	NT$5,837,488

F. The result:

After the close of field baiting in each of the 21 participating prefectures/ municipalities, a final discussion meeting was held for representatives of all townships to get together to review and discuss their experience, accomplishments, and failures. Other prefectures also sent representatives to the meeting to listen to the reports of the workers who had already completed baiting and discussed with them the details of work for their own reference. Rat tails collected in each township were displayed at the time of meeting. This provided a criterion for success of the baiting in different townships. A final provincial discussion meeting was then held on May 1958 after the conclusion of the baiting of the campaign for representatives of all prefectures and interested parties such as agricultural institutions, people assembly, newspapermen, etc. Rat tails collected in each of the prefectures were likewise shown for publicity. Prefectural governments and township public offices having done the best job during the campaign received awards from the provincial government at that meeting.

Generally speaking, the result is satisfactory. In this campaign, a total of 6,569,427 rat tails were collected from 376,103.5 ha. excluding 35,514.5 ha. of TSC-owned sugarcane farms where no collection of rat tails was made because of the difficulty of hiring labor to pick up dead rats and cut the tails. Basing on the average number of rat tails collected per kg. of 0.5% warfarin used in all prefectures and the quantity of 0.5% warfarin used in TSC farms, 333,302 rat tails were estimated to be its quota from TSC farms. This makes a grand total of 6,902,729 rat tails collected. According to experience of rat control demonstration, the total number of rat killed is estimated at 27,610,000. Farm crops thus saved from rat damage annually are estimated at 135,000 tons.

A total of 110,082.8 kg of 0.5% warfarin was used, so the average number of rat tails collected for each kg of 0.5% warfarin is 62.7. The following table shows rat tail collection in various prefectures/municipalities.

Prefecture/ municipalities	Number of rat tails collected	Kg. of 0.5% warfarin used	Average number of rat tails collected per kg. of 0.5% warfarin	Estimated number of rat killed
Yilan Prefecture	73,967	3,495	21.16	221,901—295,868
Keelung M.	2,847	240	11.82	8,541—11,388
Taipei M.	13,156	360	36.39	39,468—52,624
Yangmingshan Adm.	7,917	510	15.72	23,751—31,668
Taipei Prefecture	93,909	3,165	29.72	281,727—375,636
Taoyuan Prefecture	383,741	5,625	68.22	1,151,223—1,534,964
Hsinchu Prefecture	180,745	3,825	47.25	542,235—722,980
Miaoli Prefecture	339,785	5,340	63.65	1,019,355—1,359,140
Taichung Prefecture	308,754	6,615	46.67	926,262—1,235,016
Nantou Prefecture	221,661	4,755	46.61	664,983—886,644
Changhua Prefecture	682,312	10,832	62.99	2,046,936—2,729,248
Taichung M.	47,270	1,455	32.49	141,810—189,080
Yunlin Prefecture	957,707	12,915	74.15	2,873,121—3,830,828
Chiayi Prefecture	728,456	9,090	80.14	2,185,368—2,913,824
Tainan Prefecture	1,054,724	14,505	72.72	3,164,172—4,218,896
Tainan M.	26,700	2,235	11.95	80,100—106,800
Kaohsiung Prefecture	689,487	6,945	99.27	2,068,461—2,757,948
Kaohsiung M.	27,726	600	45.46	81,828—109,104
Pingtung Prefecture	600,814	8,345	72.00	1,802,442—2,403,256
Taitung Prefecture	52,308	1,980	26.22	156,924—109,232
Hualien Prefecture	75,891	1,935	39.22	227,673—303,564
TSC farms	333,302	5,315.83	62.70	999,906—1,333,208
Total	6,902,729	110,082.83	62.70	20,708,177—27,610,916

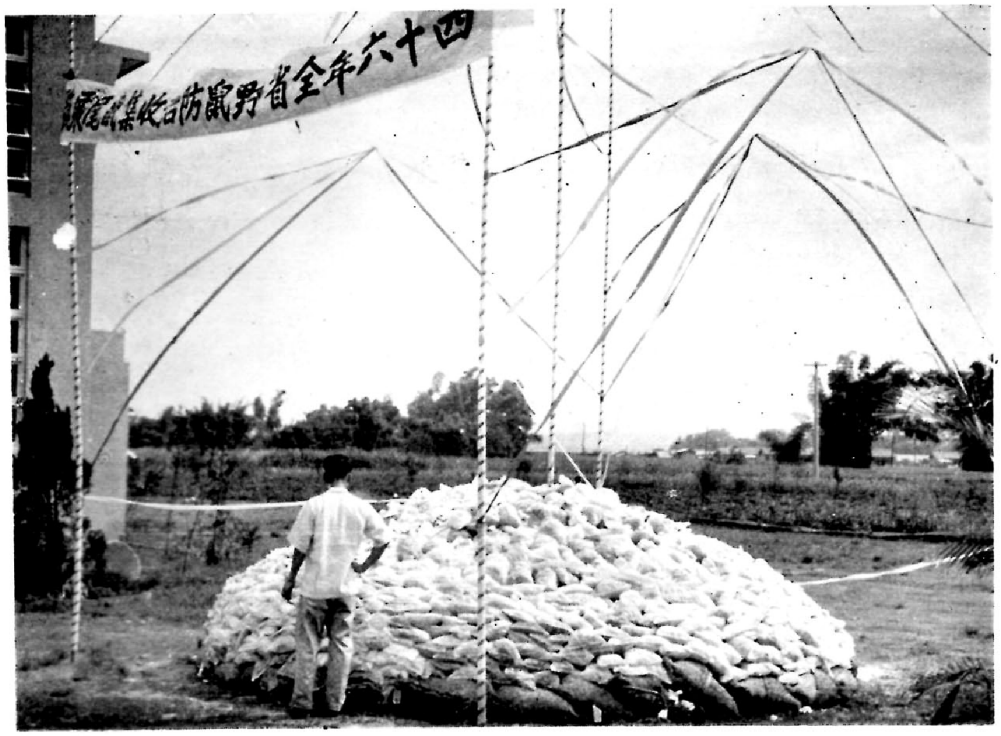
An examination of the above table reveals that the average number of rat tails collected per kg of 0.5% warfarin used varies considerably among different prefectures/municipalities. The highest number is that of Kaohsiung Prefecture, 99.27 tails/kg, and the lowest Keelung municipalities, 11.82 only. It may be concluded that the poor record of rat tail collection in some of the prefectures/municipalities is attributable to the following difficulties they encountered or mistakes they committed:



Final provincial field rat control conference after the campaign



Prefectural government having done best job in the campaign received award of the Governor from the Chairman of the Provincial Field Rat Control Committee at the final provincial conference.



Nearly seven million rat tails collected in the campaign exhibited at the final provincial conference (each plastic bag holds 1,000 tails).

1. Wet weather occurred during the baiting in many townships in the northern part and interfered with the field work.
2. Most farmers neighboring big city had no interest to submit rat tails for a tiny reward of NT$0.10/tail, because of the availability of temporary work. So, municipalities generally had poor record.
3. In those townships having big cultivated land area and baiting area but with too few people to work with farmers, the education and supervision were inadequately done. Township supervisors were discovered to have been asked to do many non-agricultural work irrelevant to the campaign at the same time when they were doing the education or supervisory work.
4. Farmers were not all clearly informed as to whom they should turn in the rat tails they collected. Farmers usually do not like to make special trips to town to submit the tails to township office or township FA for exchange of a small amount of money. In townships where village leaders, school teachers, or township supervisors were assigned to receive the tails from the village and to make direct payment, a good collection of tails was usually obtained.
5. Distribution of poisonous bait to farmers all at once, instead of distributing it 2 or 3 times in smaller separate lots. Some farmers might fill the bait

stations with bait all at once and leave it in the field without re-filling, so the bait gradually became unattractive to rats by weathering in the bait stations.

It may be seen that efficiency and coordination of prefectural agency and township offices and the township FAs in organizing and operating the control teams in prefecture, townships, as well as in villages is the key to the success of the program.

The actual cost of the campaign and the sources of funds are given below:

JCRR:			NT$4,172,488	21.7%
Provincial agencies:	PDAF	NT$ 305,000	1,665,000	8.6%
	PFB	1,050,000		
	TSC	300,000		
	PFA	10,000		
Local agencies & farmers:	Prefectural governments and FAs	1,825,054.46	13,484,279.25	69.7%
	Township public offices & FAs	4,938,796.01		
	Farmers	6,720,428.78		
			NT$19,321,767.25	100 %

Prefecture/ municipalities	Total cost (NT$)	Funds (NT$) provided by			
		JCRR & provincial agencies	Prefectural government & the FA	Township POs. & FAs	Farmers
Yilan P.	443,711.50	100,740	50,000	122,600.00	170,371.50
Keelung M.	53,701.70	29,610	11,500	—	12,591.70
Taipei M.	61,202.00	30,380	30,822	—	—
Yangmingshan Adm.	105,053.02	16,760	15,000	31,278.32	42,014.70
Taipei P.	499,848.60	126,990	63,000	116,728	193,130.60
Taoyuan P.	861,540.00	143,490	78,000	159,146	480,904
Hsinchu P.	590,560.67	132,990	37,056.36	134,571.30	285,943.01
Miaoli P.	1,064,216.00	172,740	80,000	383,862	427,614
Taichung P.	978,920.88	201,490	107,000	138,402.99	532,027.89
Nantou P.	537,377.23	116,530	66,000	168,246.22	186,601.01
Changhua P.	1,684,498.36	264,980	178,000	509,901.34	731,617.02
Taichung M.	258,946.34	63,990	121,425	37,456.98	36,074.36
Yunlin P.	2,084,248.43	279,240	141,600	615,231.63	1,048,176.80
Chiayi P.	1,189,274.00	222,990	120,000	500,128	346,156
Tainan P.	2,749,066.80	383,990	188,000	846,547.30	1,330,529.50

Prefecture/ municipalities	Total cost (NT$)	Funds (NT$) provided by			
		JCRR & provincial agencies	Prefectural government & the FA	Township POs. & FAs	Farmers
Tainan M.	204,294.00	42,150	158,174	3,970	—
Kaohsiung P.	1,096,868.96	226,490	120,000	559,880.36	190,498.60
Kaohsiung M.	95,596.00	46.780	44,600	4,216	—
Pingtung P.	1,347,399.76	319,490	152,777.10	469,224.59	405,908.09
Taitung P.	315,345.00	62,880	32,100	69,365	151,000
Hualien P.	312,190.00	64,880	30,000	68,040	149,270
Total	16,533,859.25	3,049,580	1,825,054.46	4,938,796.01	6,720,428.78
*Other expenses	2,787,908.00	2,787,908	—	—	—
Grand total	19,321,767.25	5,837,488	1,825,054.46	4,938,796.01	6,720,428.78

*Other expenses include those provided by JCRR and provincial agencies for the costs of warfarin, pamphlet, posters, leaflets, travelling for supervision and inspection by 21 provincial supervisors, etc. which were distributed to various prefectures/municipalities in kind or rendered as technical service.

To kill rats which might have escaped the baiting in this campaign or rats coming into treated fields from uncontrolled areas, a supplement project is underway to keep some permanent bait stations in the treated fields using the same chemicals. This will re-enforce extermination of the field rats and insure the long-lasting effect of the program. For this supplement project, JCRR contributed US$9,500 and NT$406,100 for procurement of warfarin and other expenses.

It is hoped that subsequent baiting by permanent bait stations in the years to come will be done by farmers themselves. The needed chemical (warfarin or other related material) will be put on sale like other pesticides at cost by concerned government agencies.

行政院農委會圖書室
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