

Market value per ton.	Unit prices.
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10/-	Rs. 6-12-6
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0/-	9-1-6
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0/-	7-0-0
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0/-	...
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0/-	...
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0/-	...
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0/-	3-10-0
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actual practice
negligible, and
variation.

from different
sources could be

L. No. 932
(e)

3.50

1.74

1.13

0.14

37.54

only small
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is almost

used in the

Grain Storage at Avadi

By

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The following is an account of the measures adopted at Avadi for the proper preservation of the large quantities of food grains that are received for storage as Provincial Reserve stocks. Twenty-five sheds with a storage capacity of 3,500 tons each are in use for this purpose. They are of the hanger design and of three different types, the Lahore, the Indian and the Avadi type.

Each had a cement concrete floor of about 330 x 100 sq. ft. The roofing was semi-circular, 18 ft. high and formed of galvanised iron sheets. Valley gutters were provided between two bays for drainage. These were lined with prefabricated bituminised rolls supported on wooden planks to prevent leakage. Each shed had eight double doors, one on either side of each bay, opening outwards over a platform running over the whole length of the shed. Drains were provided along the margins on all the four sides. The other two types had fourteen bays with a gabled roofing covering each bay. The intervening valley gutters were supported on wooden planks spread over seven brick pillars erected at intervals along the length of each valley gutter. The effective storage surface in each bay was 21 x 95 sq. ft. The Indian type had brick walls on all the four sides with the roofing made of Mangalore tiles. Each shed was provided with ten sliding double doors, four on either side along the length and one in each of the other two sides. A covered verandah was provided on the loading side for the entire length. In the case of the Avadi type sheds, the walls and the roofing were made of galvanised iron sheets and the doors were hinged and opened outwards on an open platform.

Among these three types of sheds, the Lahore type was found to be the best. The doors on either end helped proper aeration for all the stacks since it was possible to arrange two rows of stacks with a central gangway in each bay. The semi-circular roofing gave sufficient room for the easy handling of bags in the top layers. In the other two types only four bays out of fourteen had doorways and only one stack could be arranged along the width in each bay. This resulted in insufficient aeration for the stacks in the interior. The handling of bags in the top layers was also difficult because of the tie beam of the gabled roof.

All these sheds were provided with a network of railway lines on one side and metalled roads on the other side running along the length of each shed. This facilitated the despatch of grains by road and rail.

The arrangement of the stacks inside the godowns was designed so as to give sufficient alleyways around each stack. In the Lahore sheds each bay had two rows of four stacks, $14 \times 20\frac{1}{2}$ sq. ft. in area, with a gangway of 3 ft. between the two rows, $2\frac{1}{2}$ feet on either side along the bay margins, 2 ft. between two stacks in the same row and 6 ft. clear space in front and back immediately behind the doorways. The stacking was done to a height of twelve tiers. The bags were arranged brickwise. The base of the stack was made a little broader than the top to ensure stability. Each stack consisted of 6 rows of 5×10 alternating with 6 rows of 7×8 bags with an additional 4 bags on the top to make 640 bags. In the case of the Indian and Avadi types each bay had four stacks of 17×19 sq. ft. area with a margin of 3 ft. on one side and one foot on the other side along the bay margins, 3 ft. between two stacks and 6 ft. clear space on either ends. Each stack consisted of 6 rows of 6×10 ft. alternating with 6 rows 8×8 ft. with 6 additional bags on the top to make 750.

The disinfection of stacks was done with gammexane D.034 containing 4% deodorised benzene hexachloride with 0.5% of active gammexane. The dosage used was 8 ounces for 100 sq. ft. of surface area with 10% extra allowance for the space between bags. The first application of the dust was commenced on the 23rd March and continued as the maize stocks were received in the several godowns and was completed by the 16th May 1948. Six cyanogas foot pumps were used in this dusting. A uniform coverage of the dust was obtained by holding the delivery end of the pump, at an angle two feet away from the stack.

During the operation, the workers covered their mouths and nostrils with kerchiefs. Twentyfive pounds of gammexane could be applied with each pump in a day or eight hours providing sufficient intervals for the workmen. The entire stock of maize 3,10,677 bags (26,033 tons) were dusted with 2,060 lbs. of gammexane.

The foot pumps were subsequently replaced with rotary pattern dusters, (Root crank dusters model C-3, A) during the second application of the dust. The duster could be operated by one man and it was possible to cover 800-1,000 tons a day using 100 lbs of gammexane. An extra man was provided to relieve him at intervals. The disinfection work was commenced on 14th June and completed

by the 27th. The despatches were treated with 1

The total July and the tons) which 471 lbs of gammexane known as "To engine run on mounted on a handle and connected and gangway with this dust of dusting will using 500 lbs

Disinfection of stack disinfection releases. The of surface. continued till in all the nine

The 3 pies per ton lbs. of gammexane disinfecting quantity of

The and once a the insect pumps were drawn selected at each bag. was reduced spread out percentage stack and grains of a from May to August as result of

by the 27 th. in all the godowns. The stocks ear-marked for immediate despatch were not treated. 2,87,050 bags (about 23,921 tons) were treated with 1,944. lbs of gammexane in all the nine godowns.

The third and final dusting was done in the last week of July and the application of dust was confined to 70,180 bags (5,848 tons) which were likely to remain in storage till the end of August. 471. lbs of gammexane were used for disinfestation. A powder duster known as "Tornado marvel" worked by a "Villiers" 4-stroke air-cooled engine run on petrol was tried in these godowns. The machine was mounted on a chassis and fitted with pneumatic tyre wheels and pram handle and could be easily moved between stacks along the alleyways and gangways. It was possible to cover the four sides of the stack with this duster. The top surface required an extended hose. The rate of dusting with this machine was calculated as about 500 tons a day using 500 lbs of gammexane.

Disinfestation of empty godowns was done side by side with stack disinfestation as and when the godowns become empty after the releases. The dosage used was 8 ounces of gammexane for 100 sq. ft. of surface. This was commenced in the first week of July and continued till the end of August. 868 lbs. of gammexane were used in all the nine maize godowns.

The approximate cost of disinfestation worked out to 1 anna 3 pies per ton for a single application. At the Avadi godowns 5,443 lbs. of gammexane were used for the three applications and for disinfesting empty godowns. The cost spread over for the entire quantity of maize stored works out Rs. 0 — 2 — 8 per ton.

The stocks were examined at the time of receipt at the harbour and once a month in the godowns in May, June and July 1948 to note the insect population and percentage of tunnelled grains. Samples were drawn with a sampling pin 8 inches long from 3% of the bags selected at random in each stack collecting a handful of grains from each bag. The insect population in the sample was noted and was reduced to one pound. The collected maize was then spread out and about 1,000 grains were sampled out to note the percentage of tunnelled grains. Observations were recorded for each stack and the average insect population and percentage of tunnelled grains of a consignment were worked out. 716 samples were examined from May to July. Further examinations were discontinued from August as the stocks were despatched from the godowns. The result of examination are given in a separate statement.

The population counts showed the presence of the rice weevil (*Sitophilus oryzae*) and the flour beetle (*Tribolium castaneum*) in all the consignments at the time of their receipt in the Madras Harbour. The number of weevils (*Sitophilus oryzae*) did not increase to any appreciable extent during the first examination of the stocks in the godowns in May. Their number was definitely low in the June observations and in July live insects were absent in several godowns. This was mainly due to disinfestation with gammexane D.084 which reduced the weevil population to a great extent. The first application of the dust in March-April resulted in a large number of dead insects along the stack margins and on the bags. These were brushed and cleanly swept before the second application. The activity of weevils beyond this period was considerably reduced and the insect population in subsequent counts consisted largely of the flour beetles. The effect of gammexane on these beetles was comparatively less. The percentage of tunnelled grain showed considerable variation and inconsistency in the different readings.

The maize stocks remained in storage for over five months 26,033 tons of maize were received from the middle of March to the end of April and 25,788 tons were despatched to several districts of the province from May to September. 26½ tons of maize were separated as damaged stocks due to leakages in some of the godowns during rains. About 12 tons out of this quantity were auctioned as starch and the rest disposed off as manure. Thus the over-all shortage for the entire stock of maize was 218½ tons for 26,033 tons handled or 0.84%. The grains at the time of receipt were weighed at the Madras Harbour after a long voyage and must have weighed more. These were standardised at Avadi in the hot months from April to July when the grains must have weighed less. Therefore the shortage of 218½ tons might be mainly due to the fluctuations in the weight of the grains on account of climatic conditions. It could be claimed that this loss in storage was negligible.

Previous experience of maize storage at Madras had shown that the weevils (*Stophilus oryzae*) infesting the grains multiplied very rapidly. In the case of maize stocks received in December and January the weevils were seen to be swarming in all the godowns by the end of February and their population multiplied 10 to 12 time by the end of May 1948. The low insect population at Avadi and the complete control of weevils were the results of adopting timely preventive measures.

STATEMENT SHOWING THE DEGREE OF INFESTATION IN DIFFERENT MONTHS.

Examination at the Madras	Examination in the Avadi godowns during May, June and July 1948.
May 1948	July 1948.

STATEMENT SHOWING THE DEGREE OF INFESTATION IN DIFFERENT MONTHS.

Name of the Consignment	Date of receipt into the Harbour	Examination at the Madras Harbour				Examination in the Avadi godowns during May, June and July 1948.																			
		May 1948.				June 1948.																			
		Numbers of samples examined	Setophilus alive	Sitophilus dead	Tribolium alive	Tribolium dead	Percentage of tunnelled grains	Number of samples examined	Sitophilus alive	Sitophilus dead	Tribolium alive	Tribolium dead	Percentage of tunnelled grains	Number of samples examined	Sitophilus alive	Sitophilus dead	Tribolium alive	Tribolium dead	Percentage of tunnelled grains						
1. Ciclope	... 14/3	18	5	1	3	...	4.7	13	1	1	15	7	13.9	22	...	1	7	17	7.2	7	...	2	4	9	5.7
2. John Owen	... 21/3	19	1	2	2	2	3.5	39	3	...	3	6	6.3	34	...	2	8	7	6.7	113	...	1	6	5	7.7
3. Castebianco	... 27/3	15	1	...	3	...	10.4	103	1	1	16	17	15.2	69	...	1	8	19	9.2	7	5	3	33	18	11.4
4. Patagonia Victory	1/4	11	1	1	3	...	12.5	67	1	2	17	13	16.2	32	...	1	7	19	7.0
5. Rajput	... 28/3	2	7	8	2	2	4.5	51	2	7	17	17	13.1	42	7	6	8	25	13.5	28	9	4	32	16	10.4
6. Shahzada	... 7/4	4	1	...	7	3	9.8	6	...	4	15	14	17.2	3	...	1	5	15	6.4
7. Tonjor	... 9/4	4	1	...	4	6	3.7	29	...	3	13	16	13.6	7	...	3	7	19	4.4
8. Havildar	... 27/4	5	4	...	5.1	44	1	6	25	16	15.2

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of the rice weevil (*castaneum*) in all Madras Harbour. It increase to any the stocks in the low in the June several godowns. One D.034 which the first application number of dead were brushed. The activity of and the insect flour beetles. The very less. The variation and

five months March to the districts of the were separated during rains. March and the for the entire 0.84%. The as Harbour these were ly when the e of 218½ ight of the imed that

own that lied very umber and lows by 2 time by and the timely