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PRODUCTION OF MILKFISH IN COMBINATION WITH COMMON CARP AND THAI CATFISH IN FERTILIZED FRESHWATER PONDS

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INTRODUCTION

Our first tests with milkfish culture in fertilized freshwater ponds produced standing crops averaging more than 500 kg/ha (Inland Fisheries Project, 1974). This experiment was to determine if the previous results could be repeated using the same organic-inorganic fertilization program. Another more economical fertilization program using phosphate only was also followed in some of the ponds. The previous experiment was in newly constructed ponds and took place during the hot season. This experiment was repeated in the same ponds but during the wet season. Common carp, *Cyprinus carpio*, and Thai catfish, *Clarias batrachus*, were added to some of the ponds to determine if total production would be higher than when milkfish, *Chanos chanos*, was stocked alone.

MATERIALS AND METHODS

Eighteen 0.1 ha ponds were used. Half of the ponds were fertilized with chicken manure on Aug. 15 at the rate of 1000 kg/ha. Nine ponds subsequently received 16-20-0 NPK fertilizer on platforms in the usual plankton production system (Inland Fisheries Project, 1974). The other nine ponds received only 0-20-0 NPK fertilizer on platforms starting on Aug. 16. The ponds receiving P-only fertilizer were selected from those having a previous history of no or P-only fertilization while the other ponds had a previous history of organic and/or NP fertilization.

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All ponds were stocked with milkfish fingerlings averaging two g each on Aug. 21-22 at the rate of 3000/ha. Dead fish recovered after stocking were replaced. Six of the ponds, three in each of the fertilizer treatments, were stocked with catfish fingerlings averaging 2.4 g each on Aug. 22 at the rate of 1000/ha. Another six ponds, again with three in each fertilizer treatment, were stocked with carp fingerlings averaging 0.3 g on Aug. 26 at the rate of 1000/ha.

Water levels were maintained in the ponds to give mean depths estimated at 0.7 to 0.8 m. Weekly Secchi visibilities and other field conditions were noted. Dense growths of submerged weeds in the ponds were cleared by hand when they developed. On Oct. 30, a single seine haul was made in each pond to observe fish and evaluate their growth.

Wild tilapia were observed in several ponds shortly after the experiment began. Data from the Brackishwater Aquaculture Center (Inland Fisheries Project, 1974) indicated that tilapia were more susceptible to Gusathion than milkfish so one attempt was made to selectively poison tilapia. Pond 3C was treated with 8 ppb active ingredients Gusathion A on Aug. 27 which resulted in only a partial kill of *Tilapia mossambica* and *Tilapia zillii* present in the pond.

Harvest began on Dec. 18. Ponds were first seined and later drained to give a complete inventory of all fish in the ponds. Draining of the last pond was completed on Jan. 7, 1975. Culture period averaged 125 days.

Two milkfish from each pond where the fish were potentially large enough for marketing, approximately 100 g or larger, were tasted by Center staff to detect possible off-flavors. Milkfish with off-flavors and those too small for marketing were transferred to a separate holding pond. The weights of these retained fish were estimated from sampled lengths to keep handling stress at a minimum. (Grover and Juliano, in press.)

Tilapia less than six cm in length and *Macrobrachium* sp. shrimps were not included in the harvest figures because of the difficulty in picking up and sorting the many small individuals. Shrimps were found in all ponds and contributed approximately two kg additional harvest per pond (21 kg/ha) when quickly gleaned from the seine and the exposed pond bottom.

RESULTS AND DISCUSSION

The amounts of fertilizer applied and field observations are summarized in Table 1. Secchi visibilities during the experiment averaged 36 cm. Submerged plants were abundant in seven of the 18 ponds.

In the eight days following seining of the ponds on Oct. 30, a total of 71 dead milkfish were recovered from eight different ponds. This confirms our earlier experience that milkfish in freshwater are particularly susceptible to handling stress. Starting on Nov. 29 until harvest time, chronic mortalities of milkfish occurred at various times in five of the ponds. Dead and dying fish had no discernible lesions. Microscopic examination revealed no bacterial or parasitic infection. Dissolved oxygen and CO_2 levels in the ponds were considered normal. Phytoplankton abundance did not appear excessive. No satisfactory explanation for the mortalities has been found. The addition of freshwater may have helped reduce the amount of mortality.

Harvest results are presented in Tables 2 to 4. Mean net production for all ponds was 245 kg/ha. Milkfish net production in the three ponds with milkfish only treated with combined fertilizer was 285.2 kg/ha or 833 kg/ha/yr. This is less than the production in the previous dry season trial with the same fertilization system where a net production equivalent to 1006 kg/ha/yr was achieved. The difference between yields with combined fertilizer and P-only fertilizer is obscured by the presence of many wild tilapia in five of the P-only treated ponds. It is unclear if the low yields in these ponds with tilapia resulted from the tilapia or the fertilizer treatment or a combination of the two. On the average, milkfish ponds stocked with carp gave higher net production than ponds with milkfish only or milkfish and catfish.

Overall survival of milkfish was 57%, carp 59% and catfish 62%. A few additional catfish were recovered from ponds in which they were not stocked. These fish may have "walked" away from their original ponds. Small catfish resulting from recent reproduction were collected in five ponds and were not included as part of the harvest. The number of these young fish in a single pond ranged from 2 to 138. Apparently, *C. batrachus* will reproduce in at least limited numbers during November or December.

At harvest, milkfish from 11 ponds were taste-tested by the Center staff. Fish from eight ponds (1H, 1I, 2B, 2G, 3D, 3E, 3F, 3G)

were considered of good flavor. Milkfish from three ponds (1E, 2D, 2F) had an off-flavor.

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Inland Fisheries Project, 1974. Technical Report Nos. 4 and 5, University of Philippines College of Fisheries, Quezon City.

Table 1. Amount of fertilizer applied and field observations in milkfish experimental ponds at Freshwater Aquaculture Center, Aug. 15 to Dec. 18, 1974.

Pond No.	Fertilizer type	No. of applications	Total kg/ha	Mean Secchi visibility (cm)	Notes
1C	Chicken manure 16-20-0	1 4	2000 201	46	Elodea abundant
1I	Chicken manure 16-20-0	1 4	2000 201	39	
3G	Chicken manure 16-20-0	1 4	2000 199	32	
1G	0-20-0	5	249	43	Chara & Elodea abundant
2C	0-20-0	4	201	33	
3D	0-20-0	6	298	46	Elodea abundant
2B	Chicken manure 16-20-0	1 3	2000 149	26	
2G	Chicken manure 16-20-0	1 4	2000 201	25	
3F	Chicken manure 16-20-0	1 5	2000 248	39	partial fish kill
1E	0-20-0	5	250	37	Elodea abundant
2F	0-20-0	5	253	31	partial fish kill
3C	0-20-0	5	251	35	Gusathion treated
1F	Chicken manure 16-20-0	1 5	2000 252	33	partial fish kill Nov. 5
2D	Chicken manure 16-20-0	1 4	2000 200	28	
3E	Chicken manure	1 4	2000 198	46	Elodea abundant partial fish kill
1B	0-20-0	5	251	45	
1D	0-20-0	6	300	33	Chara abundant
1H	0-20-0	6	303	36	Elodea & Chara abundant, partial fish kill

Table 2. Harvest results for six ponds stocked with milkfish at 3000/ha at Freshwater Aquaculture Center, Aug. 21 to Dec. 24, 1974.

Treatment	Pond no.	Area (m^2)	Type of fish	No.	Mean wt. (g)	No./ha	kg/ha	net kg/ ha	Survival %
Combined fertilizer	1C	955	milkfish	244	115.4	2555	294.8	291.4	85
			tilapia	1	129.0	10	1.4	1.4	-
			sum	-	-	-	296.2	292.8	-
	1I	917	milkfish	160	99.8	1745	174.1	170.0	58
	3G	906	milkfish	230	157.3	2539	399.4	391.5	85
			catfish	1	114.5	11	1.3	1.3	-
			sum	-	-	-	400.7	392.8	-
Treatment mean			-	-	-	-	290.3	285.2	
P-only fertilizer	1G	922	milkfish	85	11.9	922	10.9	6.8	31
			tilapia	1632	9.5	17701	168.1	168.1	-
			catfish	4	71.3	43	3.1	3.1	-
			sum	-	-	-	182.1	178.0	-
	2C	916	milkfish	139	15.5	1517	23.5	19.4	51
			tilapia	614	15.4	6703	103.0	103.0	-
			catfish	2	135.5	22	1.5	1.5	-
			sum	-	-	-	128.0	123.9	-
	3D	906	milkfish	142	92.4	1567	144.8	136.9	52
			catfish	3	197.8	33	6.6	6.6	-
			-	-	-	-	151.4	143.5	-
Treatment mean			-	-	-	-	253.8	148.5	-
Mean			-	-	-	-	222.1	216.9	-

Table 3. Harvest results for six ponds stocked with milkfish at 3000/ha and carp at 1000/ha at Freshwater Aquaculture Center, Aug. 21 to Dec. 24, 1974.

Treatment	Pond no.	Area (m^2)	Type of fish	No.	Mean wt. (g)	No./ha	kg/ha	net kg/ ha	Survival %
Combined fertilizer	2B	866	milkfish	239	78.0	2760	210.5	206.4	90
			carp	75	114.2	866	96.7	96.4	84
			catfish	4	57.9	46	2.6	2.6	-
			sum	-	-	-	309.8	305.4	-
	2G	896	milkfish	185	118.3	2065	244.2	236.3	69
			carp	57	244.7	636	155.7	155.4	63
			sum	-	-	-	399.9	391.7	-
	3F	909	milkfish	104	97.9	1144	112.0	104.1	38
			carp	40	237.5	440	104.5	104.3	44
			sum	-	-	-	216.5	208.4	-
Treatment mean			-	-	-	-	306.7	301.8	-
P-only fertilizer	1E	919	milkfish	285	113.9	3101	353.1	347.7	103
			carp	69	298.3	751	224.0	223.7	75
			catfish	2	92.3	22	2.1	2.1	-
			mudfish*	1	60.3	11	0.7	0.7	-
			sum	-	-	-	579.9	574.2	-
	2F	891	milkfish	39	94.6	438	41.4	37.3	15
			carp	53	182.5	595	108.5	108.2	60
			sum	-	-	-	149.9	145.5	-
	3C	876	milkfish	32	30.0	365	11.0	3.1	12
			carp	24	203.7	274	55.8	55.5	27
			tilapia	92	40.3	1050	42.3	42.3	-
			sum	-	-	-	109.1	100.9	-
Treatment mean			-	-	-	-	279.6	273.5	-
Mean			-	-	-	-	294.2	287.7	-

*Ophicephalus striatus

Table 4. Harvest results for six ponds stocked with milkfish at 3000/na and catfish at 1000/ha at Freshwater Aquaculture Center, Aug. 21 to Dec. 24, 1974.

Treatment	Pond no.	Area (m^2)	Type of fish	No.	Mean wt. (g)	No./ha	kg/ha	Net kg/ ha	Survival %
Combined fertilizer	1F	913	milkfish	264	137.4	2892	397.4	393.3	96
			catfish	69	118.1	756	89.3	86.9	76
			sum	-	-	-	486.7	480.2	-
	2D	922	milkfish	175	128.1	1898	243.1	235.2	63
			catfish	84	129.1	911	117.6	115.2	91
			tilapia	1	177.8	11	1.9	1.9	-
			mudfish*	1	22.8	11	0.2	0.2	-
			sum	-	-	-	362.8	352.5	-
	3E	848	milkfish	87	113.4	1026	116.3	108.4	34
			catfish	43	151.8	507	77.0	74.6	51
			sum	-	-	-	193.3	183.0	-
Treatment mean			-	-	-	-	347.6	338.6	-
P-only fertilizer	1B	896	milkfish	225	66.5	2511	167.0	161.7	84
			catfish	68	54.0	759	41.0	38.6	76
			tilapia	20	122.6	223	27.4	27.4	-
			sum	-	-	-	235.4	227.7	-
	1D	959	milkfish	129	17.0	1345	10.4	5.9	45
			catfish	43	38.8	448	17.9	15.5	45
			tilapia	362	13.3	3775	50.3	50.3	-
			mudfish*	2	473.8	21	9.9	9.9	-
			sum	-	-	-	88.5	81.6	-
	1H	911	milkfish	21	55.6	231	12.8	14.6	8
			catfish	32	65.0	351	22.8	20.4	35
			tilapia	32	37.9	351	13.3	13.3	-
			sum	-	-	-	48.9	48.3	-
Treatment mean			-	-	-	-	124.3	119.2	-
Mean			-	-	-	-	235.9	228.9	-

*Ophicephalus striatus

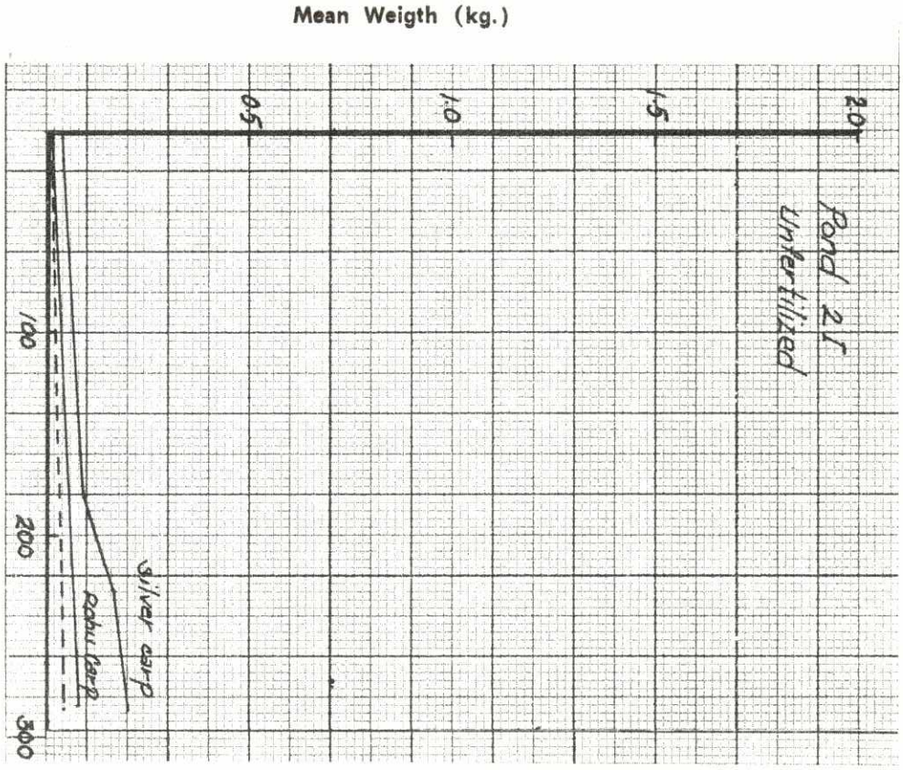

Fig. 1. Growth curves of carps in ponds at the Freshwater Aquaculture Center based on periodic sampling.

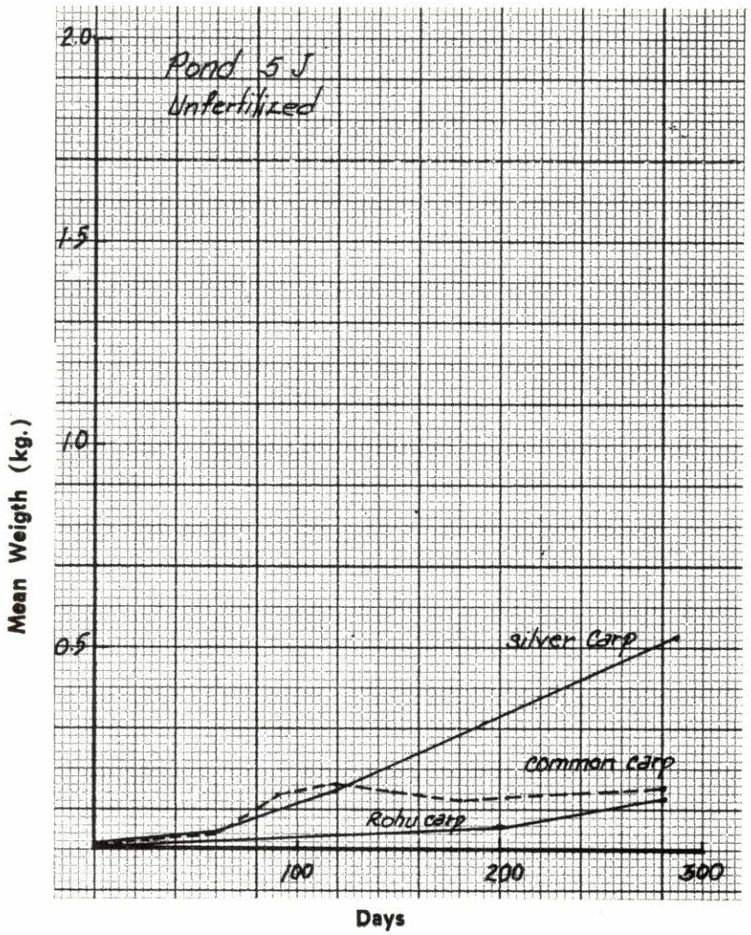

Figure 1 (Continuation)

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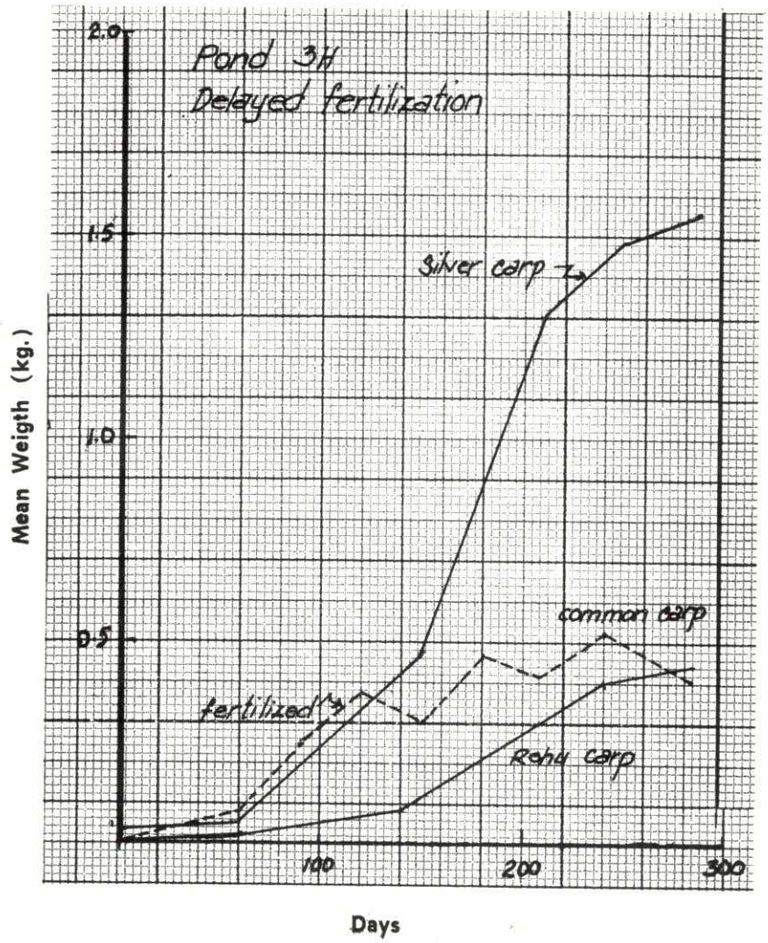

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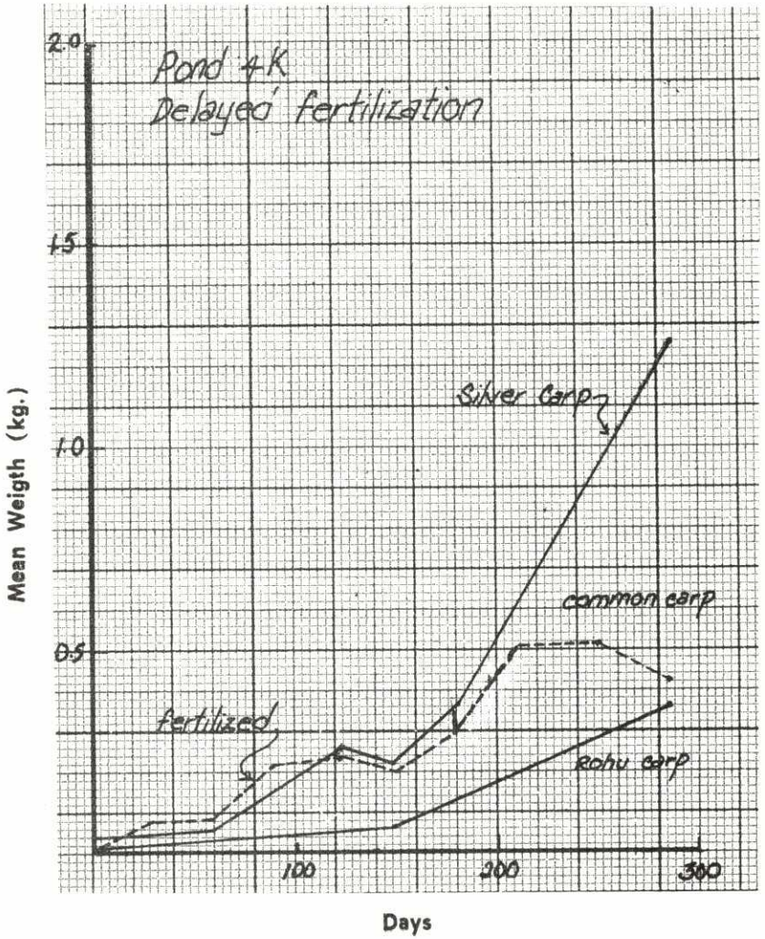

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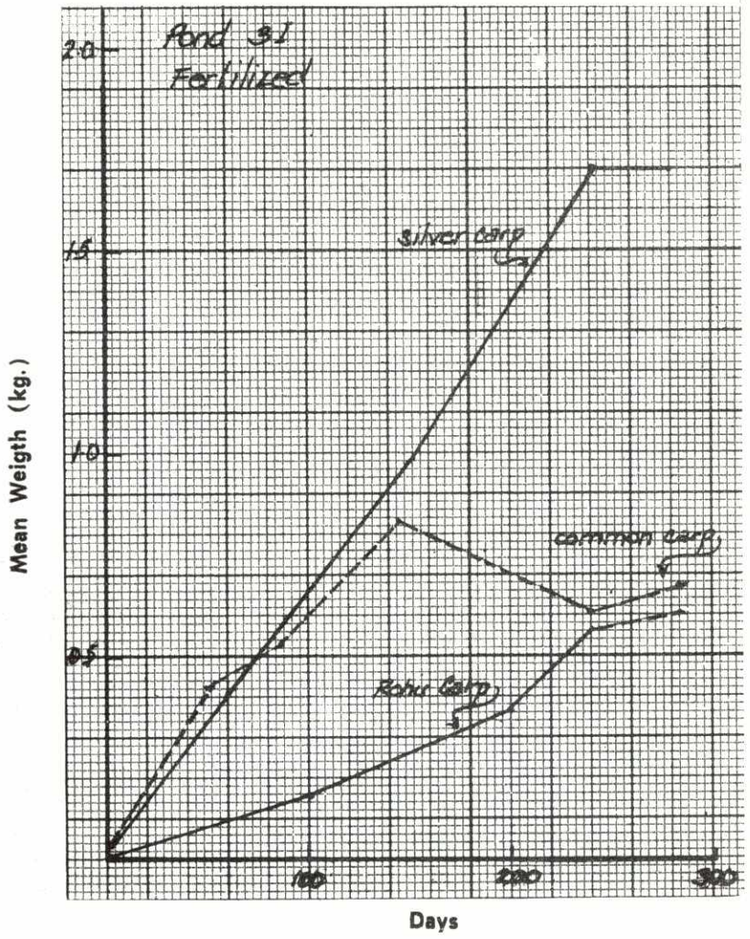

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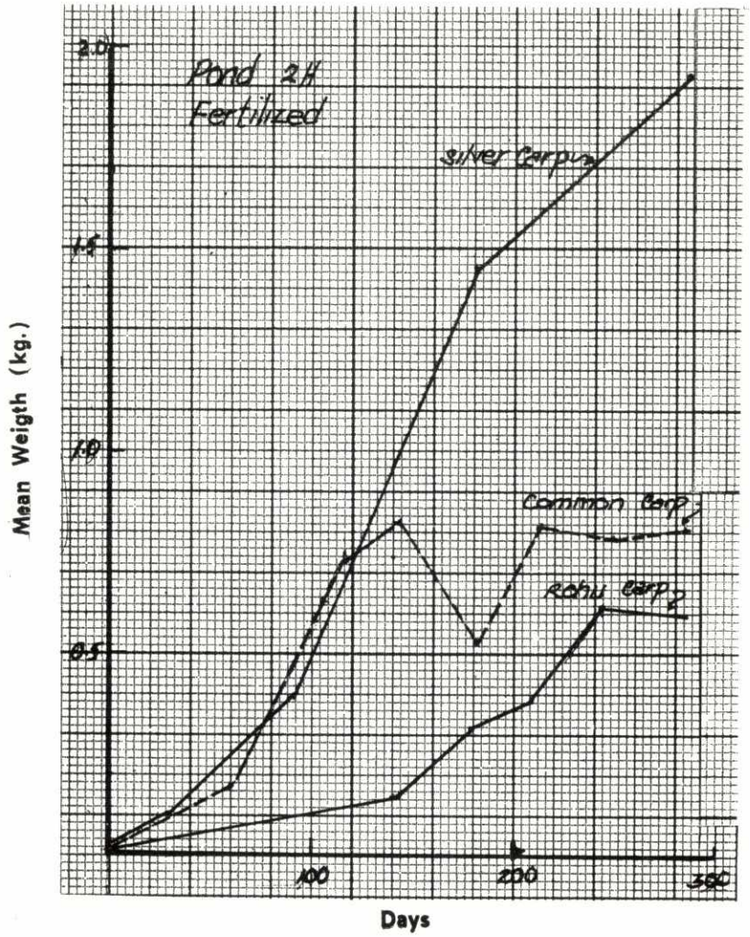

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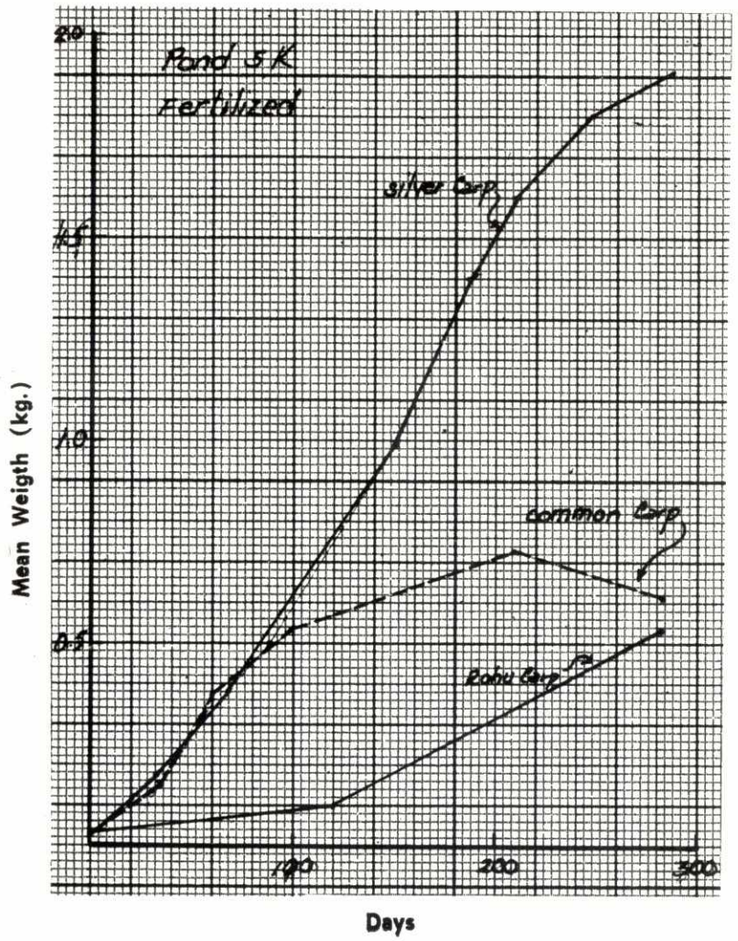

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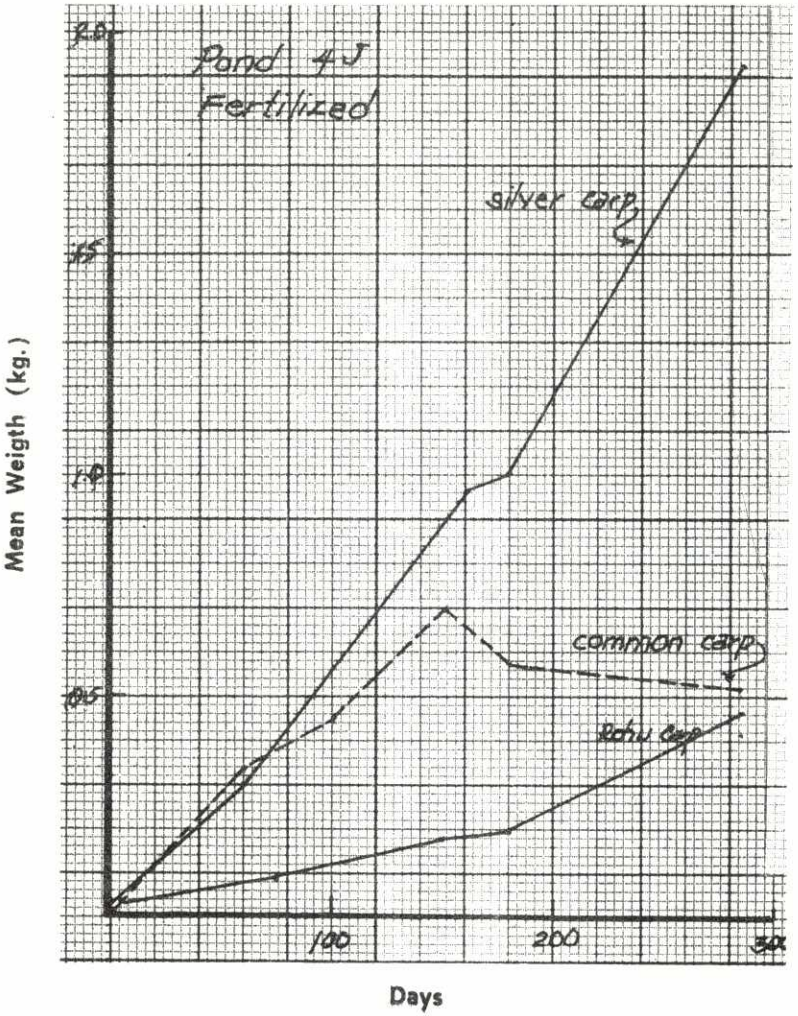

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