ecorded non-significant non-linear component and vere stable for this trait. All the three genotypes roduced above 7.5 t/ha and possessed average esponse and suitable for all environments. The enotype 2114 that produced higher stable grain ield, also produced higher dry matter which was ot stable with average response. The next best rain yielder 2122 also produced more than 8 t/ha f dry matter.

Higher harvest index was produced under nvironment - 3. The highest harvest index of 36.7 er cent was recorded by 2122 followed by 2104 35.1), 2117 (35.0), 2123 (34.8), 2115 (34.8) and 114 (34). (Table 4). All the genotypes had similar esponse except 2121 and Co. 43. The genotypes 102, 2103, 2108, 2114, 2115 and 2122 had non-ignificant, non-linear component and were stable. he genotype 2122 (SSRC 91216) produced 36.7 er cent harvest index, had average response, stable nd suitable for all environments. Two other geno ypes 2114 and 2115 also produced 34.0 and 24.8 er cent harvest index with average response and tability.

Simultaneous consideration of all the seven arameters for individual varieties showed that one had stability for all the traits. However, the enotype 2107 showed stability for all traits except traw yield and harvest index. Genotypes 2108, 109, 2114 and 2115 for four traits, and 2103, 111, 2119 and 2120 for three traits showed tability. The stable high grain yielder 2114 also ecorded high and stable mean values for effective illers, straw yield and harvest index. The next high rain yielder also recorded high stable mean values for straw yield and harvest index. Bhattacharyya (1976) and Ikehashi (1979) also identified some genotypes for problem soils.

Genotype SSRC 91216 (2122) had dwarf stature (65.0 cm) reaches 50 per cent flowering early (82 days) produced 8.3 effective tillers/hill, recorded average grain yield of 3086.3 kg/ha, produced 5.2 t/ha of straw, 8.23 tonnes/ha DMP and recorded 36.7 per cent harvest index. It showed stability for two traits viz straw yield and harvest index. Another culture SSRC 92217 (3072 kg/ha), straw yield (5.8 t/ha) and harvest index ($3^4$ per cent ) These two genotypes possess the genes to alter the physiological basis of the yield contributing traits under stress conditions and has the ability to attain higher grain yield.

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# RURAL INSTITUTION FOR IRRIGATION MANAGEMENT*

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## ABSTRACT

Green Revolution was successfully accomplished in India wherever irrigation and drainage facilities are available. Irrigation is the single major input which decides stabilised and increased production in this country. In a tropical region like South India, where "the only normality in the rainfall distribution is abnormality and the only certainity in the rainfall distribution is uncertainty" irrigation management is important. In agricultural sector, many changes have taken place. Irrigation management in India aiming higher productivity and equity is a non-traditional approach since this society is static, stagnant and hierarchial in character.

India is considered to be a museum of societies s evidenced from the existence of pre-literate society (tribal groups), peasant society (village communities), pre-industrial society, (small

artisans) enterprenecurial society (private industries) and corporate (Government Sector) society. Among them, the peasant society accounts for 70 per cent of population mainly engaged in agricultural (including livestock) activities. Peasant society or agricultural society is characterised by its hierarchial setting in which, the duties and responsibilities are supposed to have been pre-ordained due to *Karma* (fate) and *dharma* (duty according to one's varna and caste). Village communities, their members (Farmers) are influenced by their social values which are decided by their religious values. Socio-cultural norms decide any organisation or participation including irrigation organisation. It is important to note, that in villages, the only organisation existing since long time is the caste organisation (caste panchayat). "Agriculture is the main-stay of the rural economy and so, the entire economic and social structure revolves round it. All the rural occupations were generally integrated with agriculture on the basis of caste and constitute the pivot of the whole system in the rural areas. The landless labourers belonging to the Harijan Castes, have obligations to serve the need of the farmers" (Kuppusamy, 1972).

Barring few exceptions, farmers' organisations including irrigation organisations in the past and present are suffering from inefficiency and are hence unsuccessful in general. Farmers with low level of literacy, lacking social values, antagonistic material values and discordant prejudices could not get organised for agricultural activities. However, informal organisations are not uncommon. With reference to irrigation organisations and participation, all types of complexities are existing. Especially during scarcity years, the functions of the formal and informal organisations in turn, the participation are at risk. In fact, serious tensions and conflicts are very common in many areas either in canal fed areas or in tank irrigated areas. Conflicts are frequent between relatives as in the case of sharing common well of their ancestrol property or in tank irrigation. In river command, system tanks (tanks drawing water from canals in addition to rain water collection) are forming part of the system. Some tanks also feed canal system. Tanks act as balancing reservior in canal commands.

Rotational Water Supply System (RWS) has been designed and operated by the Department of Agricultural Engineering in Periyar Vaigai Project of TamilNadu. In the recent past, individual farmers were involved to share the water in accordance with time schedule. In turn, groups of farmers engaged casual labourers for irrigation. At present, irrigation schedule in terms of time of flow is being implemented by involving a group of farmers by apportioning for every block or strategic outlet command (SOLC). It is observed, the RWS could be successfully implemented if the required quantity of water is supplied with all certainity.

In the absence of enough storage in the reservoir, turn system is being introduced, in which, few branch canals are operated during a part of the week and the remaining branch canals during the remaining part of the week. When the shortage is severe, water would be totally stopped in the main canal for few days. In case, there is rainfall the situation will ease. The tail end farmers are the sufferers during scarcity periods. The farmers of head and middle reaches are also not free from water scarcity problems.

In the year of normal water supply, continuous flow is allowed in the main and branch canals based on the availability, requirements of the area, season and rainfall. Individual farmers draw water to meet the need of the crop to maintain 5 cm depth. Most of the farmers are satisfied with the water application method of impounding 5 cm on disappearance partly due to the extension activities of the Department of Agriculture, Agricultural Engineering and Tamil Nadu Agricultural University and partly due to scarcity, experienced in the past few years.

In the scarcity years, farmers share the water in turn system to apportion the limited quantity of water approximately equal. However, turn system is not free from problems. Especially during land preparation for first crop, scarcity of water interferes with the puddling operation and even with transplanting. The peak demand of water requirement (irrigation requirement) is during the land preparation of first crop. Further, for the crop growth and development stages, turn system with acute scarcity results in application of water at prolonged intervals. In most of the cases, irrigation

is given after formation of cracks on the soil. The interval would be even 10-11 days as against irrigation (with 5 cm depth) twice a week during the first crop on normal occasions. Scarcity during the months of October to December could be managed relatively easier as compared to the first season due to the fact, that the water requirement is relatively lesser than the first season and due to rainfall also. The normal interval is once in a week with water depth of 5 cm impounding. It has been observed that farmers could easily manage a scarcity to the tune of 25 to 30 per cent.

## METHODOLOGY

The methodology to study the Rural Institution for Irrigation Management involves a non-conven tional approach of studying through Water Manage ment trainees in the Periyar-Vaigai command and an Operational Research Project (ORP) launched under the aegis of ICAR project for Water Manage ment. In fact, the latter was taken up first and the study on the Water Monitoring Institutions (*Neer Maniyamgal*) was taken up at a later date.

The ORP at Madurai was launched in 1983-84 and data were collected on the water use. Irrigations were attended by common workers. In the year 1987, the trainees of Irrigation Management training for Periyar-Vaigai Command Project were actually involved in the study on the existing rural institutions in Cumbum Valley under the leadership of the trainer. Studies were taken up in Chinnavaikkal of Cumbum. Three groups of trainees had conducted the studies with designed questionnaire. All the three groups of trainees have studied the functioning of rural institutions by interacting with leaders of the informal Farmers' Organisation, Water Masters *(Neeranikamgal* and Irrigators *(Neerkattigal).* The reports were prepared based on the studies and valid conclusions were drawn on the organisation structures, functioning for irrigation management. Hence, two sets of studies *viz.*, one from the Operational Research Project at Madurai and the other from the field investigations are made use of.

## CASE STUDY IN OPERATIONAL RESEARCH PROJECT

Under the Co-ordinated Project for Research on Water Management (ICAR) of the Madurai Centre of the Agricultural College and Research Institute (TNAU), an Operational Research was taken up in 14 (R) and 15 (L) outlets of VI. Branch Canal of Periyar Main Canal in the year 1983-84. The main aim of this project was to transfer of proven technology of the scheme, intermittent ponding of water to rice crop by impounding 4-5 cm on disappearance as against continuous supply of water to maintain 5 cm (Rajagopal, 1985).

The village selected for the operational research was Koodimangalam, 23 km from Madurai City. The area of treatment and control are lying nearer. The Command Area (direct) under 14 (R) and 15 (L) are 17.7 ha and 18.0 ha respectively. Due to late release of water, only one crop was programmed with a medium duration rice variety of IR 20.

Farmers groups organised as Pipe Committees are not effectively functioning. Farmers were contacted and the importance of water management especially for scarcity years was explained and they were convinced of the importance of equi-distribution. In order to make use of farmers leadership (Anon; 1986), the help of a former Panchayat Union Chairman of the village was sought, who readily agreed to help in all possible ways. He made a general appeal to his co-villagers to help and participated in irrigation management work of the Tamil Nadu Agricultural University. He could not take active participation since he was suffering from eye ailment and stayed in his city house. Farmers also raised semi-dry nursery with the help of rains in the month of September. Wet nursery with canal water and direct seeding of mainfield were also practised. The demand for water was calculated for supply as 1 cusec for 12 h during the first 30 days. Water was released in the third week of September. Water was supplied at the rate of 1 cusec for 12 h for land preparation and transplanting. In the night time, water was sent to system tank as was customary.

Rotational Water supply was to be practised among the fields and control area of farmers *viz.*, 14 (R) command was to be supplied water as per their demand approximately 1.0 cm/ha daily. Rotational Water Supply faced major problem in regulating the supply among the fields of irregular shape, using the inadequate and untimely supply.

Water distribution has been effected at branch canal level depending upon the supply in the Main Canal. The only plus point here is the lined channel upto pipe outlet.

How to apply water to every field was a big question. There were two alternatives. The first arrangement was to obtain the help of farmers to share the water among themselves. The second alternative was to regulate the water independently without farmers. In the researchers opinion, the second arrangement was feasible. One source of inspiration for this arrangement was the traditional institutional arrangement of *neeranikam* (one who distributes between sluice outlets) and *neerkatti* (one who applies in the fields below outlet) in some other areas of this Command discussed above.

Accordingly, two casual labourers were engaged to regulate the water among the fields. It is to be mentioned, that these two labourers belonged to the working communities who are in the lower rung of the social ladder.

Another problem faced in this programme was the village factions. There were two groups in this village. It was some sort of power struggle. One group was minority in composition which was considered to be politically powerful. The basics causes of this faction was including some areas of land to 15 (L) which was previously under 13 (L). It was opposed by the majority group. Lots of doubts were expressed by the majority group on the proposed equal distribution in the year of scarcity, since the two casual labourers were previously engaged as seasonal labour by the minority group. Hence, the majority group felt that the two casual labourers would be misused by the minority group in their favour. It was assured to render justice at all cost.

During land preparation and transplanting, not much control was exercised. After the stabilisation of crops, the treatments of impounding 5 cm on disappearance of ponded water was adopted in the treatment area. The fields of treatment area were numbered serially. The fields were irrigated by two casual labourers at a time by sharing into two portions. Water application upto 5 cm was accomplished with the aid of stake marks. In case, water was not available in the branch canal, the irrigation was stopped and irrigation was started from these on the availability of water. In short farmers were not permitted to regulate the irrigation. The only irrigation function done by farmers after stabilisation was to rectify the crab holes.

In the control area of 14 (R), farmers could not get adequate quantity as per the demand due to scarcity situation. There was a quarrel between tail enders and head enders of 14 (R). Water was blocked and diverted by the head end farmers. The conflict between farmers was counselled and it was suggested to irrigate once from head and next from tail end. It was agreed upon and some sort of rotation was practised even in control area due to water scarcity. Irrigation was given to the fields once in a week except the lands lying in higher contour which were given second round in a week. Another area in the lower contour was irrigated once in two weeks.

## RESULTS AND DISCUSSION

The water management techniques adopted have resulted in a saving of 18.9 per cent of the total water requirement and 27.7 per cent of the irrigation requirement.

### Rainfall and effective rainfall

| Month | | Rainfall (mm) | Effective Rainfall (mm) |
|---|---|---|---|
| September (18-30th) | 1983 | 31.3 | 23.5 |
| October | 1983 | 92.6 | 64.2 |
| November | 1983 | 93.6 | 65.1 |
| December | 1983 | 122.2 | 81.4 |
| January | 1984 | 6.6 | 5.0 |
| February | 1984 | 17.8 | 13.3 |
| Total | | 364.1 | 252.5 |

### Water use particulars for 15 (L) Treatment

Water Supply from canals =704.7 ha cm for 18 ha.
=39.2 ha cm per ha.

Total depth of consumption = 39.2 + 25.3=64.5 cm of water

Total depth of consumption = 39.2 + 36.4=75.6 cm of water (if total rainfall in considered effective rainfall)

**For 14 (R) (Control : Farmers Method)**

Water supply from Canal = 958.7 ha cm for 17.7 ha
= 54.2 cm per ha.

Total depth of consumption of water = 54.2 + 25.3=79.5 cm

Total depth of consumption of water (if total rainfall is considered effective rainfall) = 54.2 + 36.4=90.6 cm

Percentage of saving = 18.9 per cent (total water requirement)

16.6 per cent (total water requirement if total rainfall is considered as effective rainfall)

27.7 per cent (Irrigation requirement)

Yield and yield attributes

| | 15 (L) | 14 (R) |
|---|---|---|
| Yield of (unhulled) paddy kg $ha^{-1}$ | 4835 | 4960 |
| Yield attributes: | | |
| Plant height, cm | 88.83 | 92.87 |
| No. of tillers, $hill^{-1}$ | 12.7 | 14.0 |
| No. of productive tillers, $hill^{-1}$ | 10.8 | 13.0 |
| Panicle length, cm | 24.4 | 23.9 |
| No. of grains, $panicle^{-1}$ | 145 | |

It is interesting to note that there was not much differene in the yield or yield attributes as seen from the data collected by crop cutting experiment sample, taken from an area of 5 $m^2$. Farmers felt hat the prevalent method of irrigation and regulation was purposeful and useful. The indirect command of 15 (L) was also benefited. Usually the farmers of the direct command of 15 (L) were enjoying the major share of water even in normal years denying the due share of indirect command. For the first time after a span of five years equity was enjoyed by the farmers of indirect command of 15 (L) as a result of the Operational Research Project of I.C.A.R

It is worth mentioning that there was no regular water supply during the cropping period due to inadequate storage position in the reservoir. In the branch canal, supply was given as and when water was available. Hence the total rainfall had to be considered as effective rainfall.

World Bank Mission connected with the modernisation of Periyar- Vaigai Project made a field visit to the Operational Research Project area along with the technical staff of Public Works Department, Agricultural Engineering Department and Agriculture Department. Dean of Agricultural College and Research Institute, Madurai joined the group. Farmers were interviewed. Farmers expressed that they were happy and satisfied with the equal distribution of available water since it was regulated through common labourers under the direct supervision of the Chief Scientist and his staff. The only job they have done for irrigation was to rectify the crab holes during their regular visits. It was suggested by one of the team members that farmers may organize and employ two casual labourers on their own and meet the wages of labour for irrigation in kind at the end of harvest. Farmers replied frankly that the suggestion was good and the wages for labourers would also be reasonable. Infact, they were ready to pay around one bag (50-60 kg) per acre of paddy which was a common practice in Cumbum and few other areas, but the main problems is to organize the farmers and to get their effective participation. In their view, scarcity years are always dreadful periods resulting in conflicts, quarrels and even murders. In short, they expressed their inability to organise and wanted to arrange for regulation under government supervision in scarcity years. Such organisations and participations are possible with the help of the Government agencies according to another farmer present there.

The case study of Operational Research Project in 14 (R) and 15 (L) of VIth BC of Periyar Main Canal revealed that the farmers were not able to organise and participate for the most important input viz., water. The existing organisations were not functioning effectively. However, most of the farmers willingly co-operated, since there was an independent water regulation except one hardliner, who also co- operated after few days. They

expressed their inability to get organised for irrigation management especially in the year of scarcity. They expected a government agency to manage the situation by employing labourers, for which, they were willing to pay in cash or kind. In the case of normal years they feel that they could manage themselves even without any formal organisation. In short, farmers behaviour for irrigation organisation is lacking in social values. Farmers' organisations for irrigation cannot be viewed in isolation for irrigation only. It is related to their social values which are based on their religious values also. Farmers also have many myths and beliefs which are contrary in character for irrigation management. The strong belief in organisations and participation in them is that nothing could be achieved by organizing. They believe that individual should care for his own and his family and group action will not bring benefits. As a common man, farmers lack organising ability as a continuity of their disorganised way of life since their known past. Hence, attempts are warranted on all fronts by demythifying their myths and disprove their beliefs. Farmers are also ignorant of the water resource of Periyar-Vaigai. They feel that their branch canal alone receives lesser quantity of water. Farmers also doubt the integrity and functioning of the government officals generally. Hence, irrigation personnel have to function as teachers, workers and friends of the farmers in need. Organisations involved in irrigation management are to function in the style of an university with new responsibilities. The role of the universities are changing at present. The role of a university today is not cloistered and confined as in the past. Its function has been enlarged not in its fundamentals but in its domain. It has to take into account the common man not to perpetuate his commonness but to trim and train, guide and lead him, for he is called upon today to perform uncommon task (Annadurai, 1971).

## RURAL INSTITUTION

### View of organisor of Informal Institution

Cumbum Farmer's Association has been organised in the year 1985. The administrative set up includes president, Secretary and Treasure This organisation is concentrating on th agricultural activities of Chinnavaikkal of cumbum It enrolled 407 farmers covering an area of 140 acres. The water course is about 7 km. The tota income in the form of the contribution from th farmers is 25 bags (25 x 65 kg). Further an auctio is being conducted which fetches Rs.10-1 thousand for cattle grazing.

The functions of this institution are: To

- meet the Public Works Department Official for water release and related matters.
- regulation or irrigation water especially durin scarcity period.
- regulating water supply to enable eve distribution of water through water monitorin *neermanyam)* by employing water mast (neernikam) and irrigator (*neerkatti*).
- Water monitoring is the most importa function carried out by this association.
- Fixing up wages for farm labourers is als taken care of by this association.
- The normal water application technique i maintenance of 5cm during the normal year of water supply and impounding 5 cm o disppearance during scarcity years.

### Duties of water master

There are nine water masters who take charg of the water from the Luscars of the public Work Department and distribute between sluices. The distribute the water in accordance with th requirement in the normal years an proportionately during the scarcity years. Th wages for water masters is two bundles of padd heaves ie., unthrashed paddy earheads with straw which may give 8 to 10 kg/ac (ie. average 9 kg/ac.)

- Wages 9 kg per acre and for 1400 acres th total wages is 9 x 1400 = 12,600 kg
- Wages per water master 1400 kg.
- They are also supervising the works o Irrigators

All the Water Masters interviewed were from the lower strata of the society. They are satisfie

with their job and wages paid to them eventhough many of them were well educated and employed in the Government Sector holding respectable posts.

Water masters of Chinnamanur area were also contacted. The responsibility and the working condition are almost the same as that of Cumbum area. It is understood that the Water Masters are not not satisfied with the wages paid in this area. The *'Neeranikams'* interviewed in Chinnamanur area were middle level castes. The appointment of water masters is heriditary and also decided by local farmers who dominate the farmers' association. There is no job security for water masters in this area possibly due to misunderstanding between the water masters and the dominant members of the farmers' association.

**Views of Irrigators**

Irrigators also founded an association and registered under societies act. The works of Irrigators are preparation of nursery, making temporary cart tracks (cutting the bunds of paddy fields) for transporting the manure, irrigation to nurseries and spraying and dusting chemicals.

The responsibility of irrigators is actually to irrigate the individual fields. The area is 8 to 10 acres and the wage paid is around 60 kg per acre.

On the future of this organisation, the office bearers informed that it has good hopes since the functioning is impartial and vital directing towards equity in irrigation water distribution. The expectation of this organisation is the redressal of grievances by all Government Department as and when representations are made. Farmers also want lining of channels, field water courses, formation of cart tracks and provision of thrashing floors. It is also felt by the farmers that the underground water resources must be tapped through community borewells for conjunctive use of water. The members of the farmers associations of Karunkattankulam of Chinnamanur were also met and their views were assessed. Here also there is a farmers association covering 436 members. This organisation is an existence for the past 34 years. The contribution by the members is 8 kg/acre/member/season. Further there is also income of Rs.5,000/- collected from duck owners for grazing of ducks.

**Views of Water Masters**

Water Masters supervise the irrigators and their relationship with the farmers in cordial. Watchmen were also engaged from three castes at the rate of five from each caste for the purpose of watchward and to assist.

Wages for irrigation work at the field level is 50 kg/acre. Each Irrigator is incharge of 15 acres. The irrigators want that the wages are to be increased whereas the farmers are not willing. In addition to this, Irrigators are getting a low rate of wages ranging from Rs.1 to 3 for attending the works like nursery preparation, application of plant protection chemicals etc.

The work of Irrigators is very crucial. They attend to the irrigation at the night time. They adopt some sort of rotation system during scarcity years. They maintain 5 cm during normal years and impound 5 cm on disappearance during scarcity years. They also expressed that their job is very risky and there were incidents of attacks by reptails.

Irrigators are also employed in the Karunkattankulam PTR channel of Chinnamanur block. The wages paid in this area is 25 kg/acre. He is incharge of 25-acres. Total income is around 1250 kg. Irrigators also do night irrigation and they maintain 5 cm standing water during normal years and impound 5 cm on disappearance during scarcity years. The Irrigators feel that their wages are to be increased from 25 to 50 kg per acre.

In other areas water monitoring is at various magnitudes. In the 8th sluice (tail end) of 2nd Branch Canal (BC) of Periyar Main Canal on irrigator is being employed for an area of 39.67 acres (16 ha) by the farmers.

In Arumbanur tank of VIIIth B.C. water distribution has been effective by the participation of all the farmers. Individual farmers share the water either during night or during day in rotation by organisation except the village assembly. Individual farmers act as irrigators (Anon, 1985).

In the IVth BC area, Irrigators are employed only at the fag end of irrigation season if there is scarcity. Villagers hold village meeting to discuss

arrangement during scarcity. For the last one or two irrigations, irrigators are employed to distribute the water uniformly, since they believe it is a better method for distribution instead of involving all the farmers or their representatives. In Periyar-Vaigai Command water monitoring by common workers (Irrigators) exclusively for irrigations and related works are either being practised or felt necessary. The situation could be listed as follows.

**Irrigation institutions (informal)**

- prevalent in the post and followed at present
- Prevalent in the past and not followed at present
- Absent in the past and organised at present
- Absent in the past and not organised at present. Irrigation institution water monitoring is useful due to following reasons:
- Farmers are free from the ardous job of irrigation especially for rice culture.
- Available water could be distributed uniformly and independly by common irrigators.
- Conflicts are overcome which are otherwise common due to the involvement of all farmes.
- Water scarcity to the tune of 25-30 per cent could be managed by this system of engaging common irrigators since it ensures uniform distribution of available resource.
- Water courses are also maintained by this (informal) organisation.

As such Water monitoring institution is an informal rural institution existing in Cumbum valley as the continuity of the past. This is a simple institutional arrangements to manage irrigation at farm level. This institution is not contradicting one to formal institution or irrigation Co-operatives. This is worth emulating in other areas. Studies carried out in Periyar-Vaigai Command revealed effective functioning of water monitoring institution (Sivanandam, 1986).

## SUMMARY

Periyar-Vaigai Porject has been experiencing water shortage for considerable number of years. Water distribution method in Periyar- Vaigai does not fall under usual water distribution methods like 'Rigid methods' or 'Flexible Methods'. In the normal years, there is continuous flow of water in the main canal, branch canals and field water courses. Modernisation is useful in conveyance and to avoid seepage losses. In the years of scarcity no defined waer distribution method is followed. There is turn system without assured time interval or quantity. Impounding of 5.0 cm water on disappearance in rice is a useful water application method without sacrificing the yield in Periyar Vaigai Command. Water monitoring the informal farmers, institution engaging water masters, common irrigators exclusively for irrigation is purposeful, useful and feasible. Engaging separate irrigators was found successful under operational Research on Irrigation Management for Rice in Periyar Vaigai Project. This institution is to be encouraged by motivating the farmers in the existing Block Committees and Sluice Committee or with the involvement of officials of Agriculture. Agricultural Engineering or Public Works Departments. There is also scope to improve the existing rural istitutions especially on the wages for irrigation workers in kind.

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