Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 15, Issue 4, 2015
PRINT ISSN 2284-7995, E-ISSN 2285-3952

CONSTRAINS AND CONSENSUS ON WATER USE AND LAND ALLOCATION IN MINOR SCHEME TANKS IN THE DRY ZONE OF SRI LANKA

Naoko OKA[1], Takeru HIGASHIMAKI[1], D.D.Prabath WITHARANA[2], Mekonnen B.WAKEYO[3]

[1]Japan International Research Center for Agricultural Sciences, 1-1, Owashi, Tsukuba-shi, Ibaraki-ken, Japan, Phone: 81-29-838-6679; Fax:81/29-838-6682; Email: okanaoko@affrc.go.jp
[2]Water Management Division, Department of Agrarian Development, No.42, Sir Marcus Fernando Mawatha, Colombo 07, Sri Lanka, Phone/Fax: 94/114379728; Email: watmngcolombo@yahoo.com
[3]Ethiopian Development Research Institute/EDRI, Addis Ababa: E-mail. mwakeyo@gmail.com

Corresponding author: okanaoko@affrc.go.jp

Abstract

In the dry zone of Sri Lanka, climate change is predicted to exert a severe impact on paddy cultivation. Paddy is cultivated with irrigation water from reservoirs called "tanks", and decisions regarding water distribution from tanks are made by farmers in cultivation meetings which are held before cultivation seasons. In this study we focused on the bethma practice and other field crops cultivation which are potentially adaptation measures to climate change, but are not actively applied. This study tries to find constraints on applying bethma practice and other field crops (OFC) cultivation for better adaptation to climate change. We investigated the current status of bethma practice and of OFC cultivation, the reasons for the decline of bethma, and the manner in which farmers arrive at a consensus on water and land use. For the investigation we used survey data and observation of a cultivation meeting in a study area. We found that bethma is rarely applied at present and the reason is largely based on human perception of dislike of bethma, due to the unfairness in sharing responsibility in land use. This results in not only the decline of bethma but also disagreement on cultivating OFC with tank water. The lack of mechanism to arrive at a consensus between owners of suitable land and land users is a key constraint to practicing OFC using tank water. When farmers try to adapt climate change through water and land management or OFC cultivation, a new mechanism is necessary to ensure fairness in sharing responsibility for land use.

Key words**:** *bethma, irrigable land, water management and land allocation, small-reservoir, Sri Lanka*

INTRODUCTION

In the dry zone of Sri Lanka, climate change is predicted to exert a severe impact on agriculture. Particularly for paddy cultivation which is the dominant crop of the country, irrigation water requirements are predicted to increase due to climate change [2] [3]. In this area, paddy is cultivated with irrigation water from reservoirs called "tanks". Among these tanks, those serving less than 80 ha (1 ha =2.47 acres) are classified as minor scheme tanks. Minor scheme tanks are managed by farmers and decisions regarding water distribution are made by farmers in cultivation meetings which are held before cultivation seasons. These decisions are made basically according to the customary water rights. In the customary water rights, the service area of a minor tank is divided into Puranawela (old paddy fields) and Akkarawela (new leasehold paddy fields), and the Puranawela gets priority in terms of water issues. The extent of Akkarawela to be cultivated would be decided in a cultivation meeting according to the amount of rain and runoff water that would be collected in the tank [9]. In case that no agreement is reached in a cultivation meeting, water may not be used for agriculture as water is considered as a communal property.

In water shortage season, water and land management practice known as "bethma" may be applied to use limited water equitably among farmers. The United Nations Educational Scientific and Cultural Organizations defines bethma as a practice that temporarily redistributes plots of land

among paddy landowners in part of the command area of a tank during drought periods. It is practiced when enough water is not available to cultivate the entire command area or Puranawela. In some cases, the land distribution in bethma practice is proportional to the landholding size, but in most cases, the same size of land is distributed to each land owner [11].

Although it is considered that bethma practice can be a key feature to adapt to climate change through utilizing limited water resource in equitable manner, it has been reported that the number of villages practicing bethma has gradually declined over the years influenced by water use insufficiency caused by population growth and expansion of irrigated area, or changes in farming activities from paddy to cash crops caused by diffusion of agro-wells [6] [10].

Another adaptation measure to climate change is crop diversification with other field crops (OFC) cultivation because OFC such as chili, soybean, finger millet, green gram, consume less water and generally increase farmers' income. Sri Lankan government has developed a "National Climate Change Adaptation Strategy" that specifies adaptation measures including crop diversification to ensure that food production meets nutritional demands and promotion of water-efficient farming methods to ensure adequate water availability for agriculture [8]. In minor scheme tanks, one major crop diversification strategy is to cultivate rice in one cropping season and other field crops or vegetables in another cropping season instead of double cropping rice [5], or promote third cropping season cultivation as seen in "Accelerated OFC production program [7]".

If, water insufficiency and change of farming activities from paddy to cash crops is the main reason for not applying bethma, there can be wider OFC expansion which consumes less water and create more income. However, self-sufficiency rate of OFC is lower than the national development goal [1]. It is assumed that there are other factors or relations between not applying bethma and not cultivate OFC instead of rice. Knowing these factors and relations can give important insight on how to build adaptation strategy to climate change in dry zone of Sri Lanka.

Thus, this study aims to find constraints on applying bethma practice and OFC cultivation for better adaptation to climate change. For this purpose, we looked into the current status of bethma practice and of OFC cultivation, the reasons for the decline of bethma, and the manner in which farmers arrive at a consensus on water and land use, by conducing survey and observing a cultivation meeting.

MATERIALS AND METHODS

Study area

The study area is Thirappane Division, Anuradhapura District, North Central Province in Sri Lanka. This area belong to the dry zone, the dry season extending from May to September (Fig. 1).

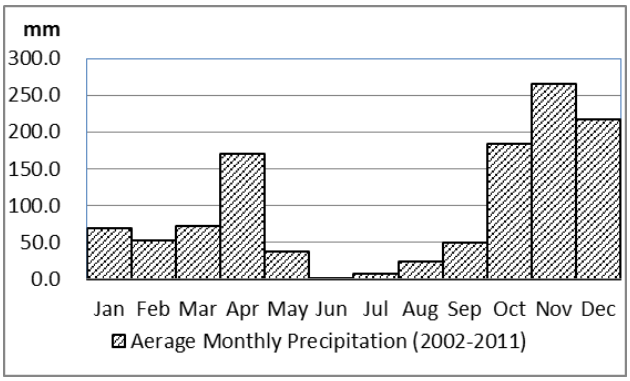

Fig. 1. Average monthly precipitation in Anuradhapura District
Source: Nachchaduwa meteorological station in Anuradhapura District, Department of Meteorology, Sri Lanka.

In the study area, two major cropping seasons exist. One is "maha" cropping season which extends from October to March, with relatively abundant rainfall. The other is "yala" cropping season which extends from April to September, with relatively small amount of rainfall and cultivation is heavily dependent on tank water. In addition to these, farmers cultivate the third cropping season "meda" which is from March and April under certain conditions including some remaining water in a tank.

Questionnaire Based Survey on bethma and OFC

A survey was conducted from June to July 2012. Respondents to the questionnaire are representatives of Farmers Organizations (FOs) on minor scheme tanks in Thirappane Division. FOs are organizations established pursuant to Agrarian Development Act No. 48, 2000, and are registered with the Department of Agrarian Development (DAD). A questionnaire was prepared in local language and asked respondents about each tank. "Agriculture Research and Production Assistants (ARPA)" of Thirappane Agrarian Service Center (ASC), DAD, administered interviews to representatives of FOs and filled out the questionnaire. According to Thirappane ASC, there are 120 minor scheme tanks and in total, 87 questionnaire sheets were collected.

Observing a cultivation meeting

To identify the manner in which farmers arrive at a consensus on water distribution and land reallocation, we observed a cultivation meeting for one tank in Thirappane Division in March 2014.

In usual case, FO organizes a cultivation meeting that is held before the beginning of each cropping season. In this meeting, decisions are made regarding matters including the area to cultivate, the variety of rice, the cultivation calendar, the period for distribution of water, the maintenance of irrigation infrastructure schedule, and the penalty for violations.

Observed cultivation meeting was held to decide on the cultivation of an OFC, green gram, for the meda cropping season. As usual for cultivation meetings, an ARPA observed the meeting. Along with the ARPA, an "Agricultural Instructor (AI)", an extension workers of the Department of Agriculture attended the meeting to explain the cultivation method of green gram and support that would be provided from the government.

RESULTS AND DISCUSSIONS

Result of questionnaire survey

The overview of respondents are presented in Table 1. It was known that there are many cases that one respondent answers for several tanks. In addition, it was known that on average, one FO covers 2 tanks and rage was from 1 to 5 tanks.

Table 1. Overview of respondents

	Number
Number of tanks	87
Number of respondent farmers	44
Number of respondent FOs	40
Number of respondents belonging to Grama Niladhari* units	22

Source: computed from the data
*Grama Niladhari is an administrative unit under the Division

In question 1, respondents were asked to choose the implementation status of bethma from three choices. Results are shown in table 2.

Table 2. Implementation status of bethma

Choice	number of response
1-a, Bethma was applied within the past 5 years (from 2008 to 2012)	1
1-b, Bethma was applied up to some year; but it is not applied at present	37*
1-c, Bethma have never applied	73*

N=79, *includes 32 double answers including both b and c

Table 2 shows that for most tanks, bethma is not applied at present or has never been applied. The rate of applying bethma in the past 5 years (2008 – 2012) is only 1 %. The rate is much lower than that in other surveys, for example, 34% of villages implemented bethma during 1990 – 2001, and 25% of villages implemented bethma during 1995 – 2001 among 44 traditional villages in the two Divisions of Ipalogama and Kekirwa in Anuradapura District [6], or 34% among the 32 Grama Niladari in Mahowa division of Kurunegara District [4]. It can be inferred that the use of bethma continues to decline as existing studies [6] [10] shows.

Next, respondents were asked to choose answers based on their answer to Question 1.

Those who chose "Bethma was applied within the past 5 years (from 2008 to 2012)" were asked to explain the detailed method of implementation of bethma, such as number of participating farmers, means of redistribution

of farm land and means of water distribution. Unfortunately, no detailed information was collected from a respondent who had chosen 1-a. However, additional field observation and informant interview found that bethma was applied in Chili cultivation.

Those who chose "Bethma was applied up to some year; but it is not applied at present", were asked to choose the reasons for not applying bethma. Those who chose "Bethma have never applied" were asked to describe the reasons. Authors tried to find out the reasons why farmers stopped applying bethma at some point.

Responses to these questions are summarized in table 3, 4 and 5. Table 3 presents the result of multiple-choice question and Table 4 and 5 present the results of descriptive answers in Question 2-b and 2-c. Table 4 shows the reasons for not applying bethma which are related to recognitions of responding person thus summarized based on responding person. Table 5 shows the reasons for not applying bethma which are related to tank conditions, summarized based on tank.

Table 3. Reasons for not applying bethma, multiple choices

Choice	Rate and number
1) Water is no longer accumulated in the tank during yala	48% (21)
2) Entre cultivation is canceled when water is not sufficient	41% (18)
3) Sufficient labor chance is available other than cultivation	36% (16)
4) No willingness to help people who are in trouble without farmland	30% (13)
5) Population has increased	27% (12)
6) Area of agricultural land per person has decreased	25% (11)
7) Farmers become annoyed to work together	25% (11)
8) Time is lacking for works increased in area other than agriculture	18% (8)
9) Fields were irrigated by agro-wells	14% (6)
10) Crops were grown without using much water	2% (1)
11) Water could be obtained from Mahaweli	0% (0)

*N=44

Table 4. Reasons for not applying bethma, presenting perception of respondent person

Reasons	Rate and number (multiple count)
1) Farmers dislike bethma, have no will to apply it	54%(22)
2) Farmers who own large area of land dislike bethma, have no will to apply it	17%(7)
3) Farmers are not willing to help landless people, coexist	7%(3)
4) Dividing paddy lands causes trouble	5%(2)
5) No description on recognition toward bethma but on condition of tanks	27%(11)

*Number of responded person=41

Table 5. Reasons for not applying bethma, presenting condition of tanks

Reasons	Rate and number
1)Water is insufficient to apply bethma	22% (17)
2) There are no need to apply bethma because enough water is collected	7% (5)
3) Failure experience exists	5% (4)
4) Puranawela is cultivated in water shortage	4% (3)
5) Tank has few users or is privately owned	4% (3)
6) Plot is too small in bethma	3% (2)
7) Salinity problem in yala	1% (1)
8) No description on condition of tanks but on recognition toward bethma	53% (39)

*Number of tank with response=74

As shown in Table 3, half of the tanks reported that water is insufficient and as a result they stopped using bethma. This result is in line with the finding of Kono et al. [6], that water insufficiency caused by population growth and expansion of irrigated area influences bethma application. However, the descriptive answers presented in Table 4 indicate that 54% of farmers dislike the issues in bethma, and some respondents used the word "strong dislike" as a major reason for not applying bethma, and the rate is higher compared with the first reason in Table 5, water insufficiency which is expressed in 22% of the tanks. These means that reasons based on human perception are more dominant than reasons based on tank conditions. The fact

that among respondents, 73% of them mentioned human perception but tank condition were mentioned in only 47% of tanks support this point.

In addition, dislike may occur by landownership situation; 17% of respondents pointed that large land owners dislike bethma as shown in the second reason in Table 4.

Responses on OFC implementation were shown in Tables 6 and 7. OFC cultivation is not extensive, with the cultivation area very small compared to that of rice (Table 6), and implementation rate is only 24% of tanks (Table 7).

Table 6. Area of cultivation in yala in 2012

	Area (ac)	Proportion of tank beneficiary area (%)
Paddy	1,098	17
OFC	349	7
Total beneficiary area	5,092	100

Table 7 Number of tanks corresponding to cropping patterns in yala of 2012

Cropping pattern	Number of tanks	Rate(%)
Cultivated paddy only	17	21
Cultivated paddy and OFC	4	5
Cultivated OFC only	15	19
No cultivation	45	56

*Number of tank with response=81

Result of observation of cultivation meeting

The observed cultivation meeting is held to decide whether farmers should cultivate green gram in the meda cropping season with tank water. Chaired by the president of the FO, AI explained the merits of green gram cultivation in the meda cropping season: it can be cultivated in a short period of time, water supply is needed only twice, and the Department of Agriculture is ready to subsidize seed purchases if farmers decide to cultivate green gram.

The major point of the discussion was how to use or distribute the land suitable for green gram, which comprises only part of the command area considering the soil type, ground water condition and canal network. Because tank water is their common property, usage of tank water must be agreed upon by all farmers.

Farmers who do not own suitable land for green gram supported to apply bethma, because with bethma, they have right to use some portion of the suitable land. On the other hand, farmers who had suitable land for green gram cultivation did not want to lend their land because in their experiences, the borrower did not clean the land or "show their appreciation" after cultivation as promised. In their opinion, allowing others to borrow and use their land free of charge would free those farmers from responsibility.

The officers encouraged farmers to cooperate for the benefit of all, even suggesting that borrowers should pay some fee after harvesting. However, farmers who lacked land suitable for green gram cultivation did not want to agree on tank water use until landowners agreed to apply bethma and guarantee the use of suitable land. Farmers who had land suitable for green gram did not agree to apply bethma. The meeting ended in disagreement regarding green gram cultivation with tank water.

It can be said that farmers with suitable land do not want to share land without sharing responsibility to maintain land, and farmers without suitable land do not have will to share that responsibility in addition to that they do not want others gain from tank water use.

This observation made it clear that the lack of mechanism to arrive at a consensus on sharing responsibility between owners of suitable land and land users is a key constraint to practicing OFC using tank water.

CONCLUSIONS

Bethma is rarely applied at present. The reason for this situation is largely based on human perception especially dislike of bethma by farmers who own land for bethma. The perception of dislike comes from sense of unfairness in sharing responsibility on land use. This results in not only the decline of bethma but also disagreement on cultivating OFC with tank water. The lack of mechanism to arrive at a consensus between owners of suitable land and land users is a key constraint to practicing OFC using tank water.

When farmers try to adapt climate change through water and land management or OFC cultivation, a new mechanism is necessary to ensure the fairness in sharing responsibility for land use. For example, introducing a clear compensation system or rental fee on land sharing or developing institutional system are options for future trial as adaptation measures for minor scheme tanks in the dry zone of Sri Lanka.

ACKNOWLEDGMENTS

The authors wish to thank farmers and officers in Thirappane Division, and we also like to express our special thanks to Mr. Z. Ali. M. Mowlana for his assistance to this survey.

REFERENCES

[1]Asian Development Bank, 2014, Sri Lanka: Water Resources Development Investment Program, Technical Assistance Consultant's Report

[2]De Silvia, C.S., Weatherhead, E.K., Knox, J.W., Rodriguez Diaz J.A., 2007, Predicting the impacts of climate change – A case study of paddy irrigation water requirements in Sri Lanka. Agr Water Manage 93:19-29,

[3]Eriyagama, N., Smakhtin, V., Chandrapala, L., Fernando, K., 2010, Impacts of climate change on water resources and agriculture in Sri Lanka: a review and preliminary vulnerability mapping. IWMI, Colombo, Sri Lanka.

[4]Hiraiwa, M., 2009, Analysis on the Bethma System in the Huruluwewa Irrigation Scheme in Sri Lanka. Water, Land and Environmental Engineering 77:477-481.

[5]Jayawardane, S.S.B.D.G., Weerasena L.A., 2001, Crop diversification in Sri Lanka. In: Papademitriou M.K., Dent F.J. (ed) Crop diversification in the Asia-Pacific- region, FAO regional office for Asia and the Pacific, Bangkok. pp. 112-129.

[6]Kono, H., Somarathna, H.M., 2003, Theoretical analysis of transforming of Bethma custom in Sri Lankan traditional village. Research Bulletin of Obihiro University, Humanities and Social Sciences 11:32-36.

[7]Ministry of Agriculture, Sri Lanka, 2014, Accelerated other Field Crop Production Progamme, http://www.agrimin.gov.lk/web/index.php/project/12-project/67-accelerated-other-field-crop-production#, accessed 8 July 2015.

[8]Ministry of Environment Climate Change Secretariat, 2010, National Climate Change Adaptation Strategy for Sri Lanka 2011 to 2016, Final draft. In: Climate Change Secretariat Sri Lanka, Ministry of Environment and Renewable Energy. http://www.climatechange.lk/adaptation/Files/Strategy_Booklet-Final_for_Print_Low_res%281%29.pdf. Accessed 2 July 2013.

[9]Panabokke, C.R., Sakthivadivel, R., Weerasinghe Asoka Dias, 2002, Evolution, Present Status and Issues Concerning Small Tank Systems in Sri Lanka. IWMI, Colombo, Sri Lanka

[10]Somaratna, H.M., Kono, H., 2005, Indigenous Institutions for irrigation water management and sustainable agriculture: a case study from Sri Lanka. JASRAD 15:69-76.

[11] UNESCO, 1994-2003, The bethma practice: promoting the temporary redistribution of lands during drought periods. http://www.unesco.org/most/bpik21.htm. Accessed 18 Nov 2013