Participation Scheme of Smallholder Dairy Farmers in the Northeast Thailand on Improving Feeding Systems

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ABSTRACT : A participation scheme involving smallholder dairy farmers in improving dairy productivity through the use of local feeds, on-farm established feeds and crop residues was carried out in the Northeast, Thailand. At six milk collection centers, 63 farmers with 340 lactating cows participated in this research and demonstration of feed supplements. Farmers and cows were allotted to receive respective feed supplements: high-quality feed block (HQFB), high-quality feed pellet (HQFP), dried cassava leaf/cassava hay, dried leucaena leaf and cottonseed meal: 5% urea treated rice straw was fed as a source of roughage throughout the feeding period of the dry season. Trainings and workshops were organized by the researchers at the University, research station, demonstration sites and on-farms. Regular visits to the farms by researchers and extension officers were made while discussions and demonstrations were performed in addition. Participating farmers also visited other farmers during the demonstration which offered a real practical perspective and farmer-to-farmer interaction. As a result of this participation and demonstration scheme, the farmers could learn more effectively and accepted the technology more readily, especially the practicality of the feed preparation, feed establishment, feeding method and feed reserve. Strategic supplementation of these feed supplements resulted in improving milk yield, milk quality, overall condition of the cows and higher income return through increased productivity and lower level use of concentrate to milk yield from 1:2 to 1:3 or lower. Based on this research and demonstration /participation scheme, all feed supplements enhanced productivity, however the establishment of cassava hay on farms deserved more attention and warrants a wider developmental expansion among dairy farmers since it contained high rumen by-pass protein (tannin-protein complex) and could be easily produced and be sustainable on farms. (*Asian-Aus. J. Anim. Sci. 2000. Vol. 13, No. 6 : 830-836*)

Key Words : Smallholder Dairy Farmers, Milk Yield, Milk Quality, Training, Cassava Hay, Leucaena Leaf, High-Quality Feed Block/Pellet, Cottonseed Meal

INTRODUCTION

Dairy cattle production has been one of the developmental programs put forward by the Thai government with the determination and commitment to increase milk production. Because Thailand has been able to produce milk to meet only approximately 30% of total demand, there is an enormous space for dairy business, especially for the small holder farmers. One of the important factors affecting efficiency of dairy production is feeds and feeding (Wanapat, 1990). Thailand encounters a long dry season (6-7 months) resulting in scarcity of feeds, especially high protein feed resources. Moreover, farmers tend to use a relatively high level of concentrate which in turn increase the cost of production. It is therefore imperative to study the use of local feed resources both to increase efficiency and to reduce the cost of production. Wanapat et al. (1997) reported that in the Northeast, Thailand, there were 78,998 dairy cows of which 28,897 were lactating; in addition an increase of 10,000 head/year can be contemplated under the dairy promotion and developmental plan. Based on this study, the major prevailing problem was availability and quality of feeds especially the high price of commercial concentrate which increased the cost of production. Rice straw, a major of crop-residue, is abundantly available during the dry season. Improving rice straw quality by urea-treatment (5%) has been reported and well-practiced by dairy farmers during the dry season in the Northeast, Thailand (Wanapat, 1990; Hart and Wanapat 1992).

High-quality feed blocks/pellets (HQFB/P) have been shown to be beneficial in improving ruminant productivity especially for dairy cattle (Wanapat et al., 1997; Wanapat et al., 1999). It has been reported to enhance rumen ecology especially when fed with high fibrous feeds. Dried cassava leaf, and leucaena leaf contain high protein and are well used by ruminants (Wanapat et al., 1983). However, the new finding of using cassava hay as a high protein source for ruminants especially for dairy cattle has been reported and advocated (Wanapat et al., 1997, 1998, 2000). The objectives of these trials were to demonstrate to farmers and engage then in the use of potential local feed supplements in improving dairy productivity and sustainability of the feeding system.

METHODOLOGY AND PROCEDURES

Target-farmers survey

Six milk collection centers located in the northeast

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Received February 8, 1999; Accepted September 27, 1999

Table 1. Number of cows and farms from six milk collection centers that participated in the feed demonstration and were allotted to feed supplements

Center	HQFB	HQFP	DCL	DLL	CSM	Total
Sritat	-	15[1] (2)[2]	-	-	11 (2)	26
Kudjab	21 (2)	10 (4)	10 (2)	-	10 (2)	51
Chareonsin	21 (3)	15 (3)	-	-	15 (3)	51
Nampong	18 (4)	12 (2)	22 (5)	-	8 (2)	60
Kranuan	34 (8)	27 (2)	5 (1)	9 (1)	17 (2)	92
Kantarawichai	24 (5)	8 (2)	9 (2)	9 (2)	10 (2)	60
Total	118 (24)	87 (13)	46 (10)	18 (3)	71 (13)	340[1] (63)[2]

[1] Number of milking cows; [2] Number of farms.
HQFB=high-quality feed block; HQFP=high-quality feed pellet; DCL=dried cassava leaf or cassava hay; DLL=dried leucaena leaf; CSM=cottonseed meal.

were selected to be sites for development and demonstration. Within each center, dairy farmers were selected by extension or development officers based on the farmers qualifications e.g. farmers' willingness, attitude, experience, location, number of milking cows, opportunity and potentiality for expansion of technology, and their own support and collaborations. Sixty-three farms in the Northeast, Thailand with 340 milking cows were selected to participate in the project. These cows were crossbred Holstein Friesian (75%) within first to fourth lactation periods. After the farmers and farms were identified, each farmer was interviewed for details of farm characteristics and families. All records were collected and filed to be used as baseline data.

TRAINING/WORKSHOP FOR EXTENSION OFFICERS AND PARTICIPATING FARMERS

For extension officers

A series of workshops, each for two days were organized at the University and also on demonstration sites for extension officers who would work in collaboration on the sites. A program of lectures covering details as how feed supplements could be prepared, and supplemented, how data could be collected, as well as demonstrations of feed preparation, and feeding were conducted. The feed preparation demonstration was on urea-treated (5%) rice straw using a solution containing 5 kg urea in 100 kg water, mixed onto 100 kg rice straw, then covered with plastic or other materials under roof for 10 days before feeding to the cows. Collection, harvesting and sun-drying of cassava and leucaena leaves were demonstrated for practice at the plots and at the farms.

For participating farmers

These trainings/workshops were conducted several times on different locations especially on the project demonstration plot and on farmers locations. The program consisted of lectures and practical aspects of the feeds and feeding used in the trials, especially urea-treated rice straw preparation, harvesting, sun-drying of cassava leaf/hay, leucaena leaf, high quality block/pellet making and demonstration of on site feeding of these feed supplements to the cows during milking time. Another part was a training in how feeding regimen, milk yield and essential data could be collected and filled in properly during the demonstrations.

On-sites trainings/workshops

The on-site trainings/workshops were organized on selected farms and organized in sequence on different farms. Trainings were organized both at demonstration plots and fields as well as at selected lead farms which participated: in the research and demonstration. A group of 15-30 farmers were invited to join. A host also served as a trainer and existing on-farm activities were used for demonstration.

Allocation of farmers and cattle on demonstration groups

Six milk collection centers were involved and participated; Sritat, Kudjab, Chareonsin, Nompong, Kranuan and Kantarawichai Centers, located in the Northeast, Thailand. Three-hundred and forty milking cows from 63 farms were allotted to receive five feed supplements as shown in table 1.

Preparation of feeds and feeding of dairy cows procedure

HQFB and HQFP were prepared using ingredients as shown in table 2. HQFB was made in a mold and weighed 10 kg each while HQFP was pelletted to attain 1-2 cm diameter. All feedings were done by participating farmers. HQFBs were given to the cows by putting in wooden boxes, tightly tied to the pens, which would allow the cows to lick freely. HQFPs

were given at 500 g/hd/d by feeding twice daily during milking time. Dried cassava leaf was harvested by collecting cassava leaves from the crop and these were sun-dried for 1-2 days to attain moisture content less than 10%. Cassava hay was harvested from the crop grown after 3 months by cutting the whole crop about 15 cm above the ground and sun-drying for 2-3 days; then the cassava hay was collected and fed to the cows at 0.5-1 kg DM/hd/d. Sun-drying was an effective method in reducing hydro-cyanic acid (HCN) to a safe level for ruminants. The regrowth of cassava was harvested every two months throughout the year (Wanapat et al., 1997, 1998, 2000); six cuts could be taken in a year. Cottonseed meal was given to the cows at 500 g/hd/d during the morning and afternoon milking times. The most important feature was the capacity for farmers to reduce the concentrate level to milk yield from 1:2 to 1:3 or lower while supplementing with these feeds throughout the demonstration trials during the dry season. Urea-treated (5%) rice straw was used as a sole source of roughage and fed *ad libitum*.

Table 2. Ingredients and chemical composition of high-quality feed block/pellet (HQFB/P)

	% of fresh weight
Cottonseed meal	45
Molasses	25
Urea	8
Rice bran	5
Tallow	2
Bentonite	0.5
Sulphur	1
Salt	1.5
Mineral mix and binding agents	12
	% of dry mattter
Ash	25.3
CP	43.6
NDF	38.7
ADF	17.2
ADL	11.3
By-pass/escape protein	27

RESULTS AND DISCUSSION

On-site trainings/workshop

This technique was used and emphasized as it was effective and time saving as well as using on-site farm activities, resources and farm scenery in the trainings. This technique could be used to gather farmers in a small group (15-30 persons) on a set demonstration farm, farmers farms, and could involve participating farmers in a real situation which made the farmers feel at ease and created farm-farmers-lecturers- and cows interactions. The host farmer also served as a trainer.

This on-site demonstration provided a whole new perspective and initiation for all participants under the farming environment. However, the success of on-site demonstration depends strongly on willingness of the on-site farmer, readiness of the farm, normal on-going activities, the location and the environment of the farm e.g. out-door classroom, quiet atmosphere and full participation of the host on-site farmer. These on-site demonstration workshops are recommended to be organized on a frequent basis, for example once every two months, and should be circulated on different farms on a continuous basis.

The use of urea-treated rice straw and cassava hay harvest

Rice straw is abundantly available on farms throughout the dry season. The benefit and effectiveness of urea treatment was reported by Hart and Wanapat (1990). The farmers were capable of preparing urea-treated rice straw on their farms, however variation in quality of the treated straw occurred from farm to farm depending on their close attention and understanding. The feeding of treated straw was recommended to be *ad libitum* especially during the night since the temperature was high during the day and low during night. The consistent feeding of treated straw reflected in better milk yield, milk quality and the condition of the cows. Cassava whole crop was easily harvested after 3 months of planting and sun-dried to decrease hydrocyanic acid to less than 0.5 mg%. Combined DM yield of cassava hay (6 cuts) was about 12 ton/ha. Moreover, the yield of root as a by-product at the end of the year was 70% of original yield.

Effects of feed supplements

The chemical compositions of the feed supplements are shown in tables 2, 3 and mineral concentration on table 4. These feeds contained high protein and essential mineral contents which were important to the dairy cows. The significance was the farmers could prepare these feeds by themselves, especially the establishment of the cassava plots mixed with leucaena. As indicated, milk records were collected throughout the dry season before and during the trials and the values are reported in table 5 and figures 1, 2, 3, 4, 5. As reported in table 5, the comparison within each supplement fed group was made between the pre-and during the feeding periods by using average values. For all treatments, milk yields were greater than during the pre-trial period. Increased levels of fat, protein, and solids-not fat were found in all treatment groups. Since the sale of milk was based

Table 3. Nutritive values of feeds used in the demonstration trials

	DM	Ash	CP	NDF	ADF	ADL
	%	% of dry matter				
Urea-treated (5%) rice straw	51.2	12.6	8.5	8.01	61.3	6.6
High-quality feed block/pellet (HQFB/P)	88.5	25.0	43.5	38.7	17.2	11.3
Dried cassava leaf	91.6	8.5	28.8	42.4	39.1	5.8
Dried leucaena feaf	92.0	9.1	26.7	17.1	41.0	6.7
Cottonseed meal	91.0	8.9	42.7	35.8	24.1	13.4
Cassava hay*	87.5	11.5	25.9	35.0	27.0	3.8

* Harvested from cassava whole crop at 3 months after planting and every two months thereafter, sun-dried 1-3 days and fed.

Table 4. Mineral concentrations in feeds used in the demonstration trials

	Ca	P	Mg	K	Cl	Na
	% of dry matter					
Urea-treated (5%) rice straw	0.37	0.14	0.36	0.82	0.60	n.a
High quality feed block/pellet (HQFB/P)	10.9	0.68	0.64	1.86	0.40	1.49
Dried cassava leaf	1.10	0.19	0.45	1.01	0.03	0.02
Drid leucaena leaf	0.80	0.21	n.a	n.a	n.a	n.a
Cottonseed meal	0.24	0.87	n.a	0.44	0.27	n.a
Cassava hay*	1.30	0.22	0.60	1.45	0.06	0.02

n.a = not available.

* Harvested from cassava whole crop at 3 months after planting and every two months thereafter, sun-dried 1-3 days and fed.

Table 5. Effect of local feed supplements on milk yield and compositions in farmers lactating dairy cows* during the demonstration

	HQFB		HQFP		DCL		DLL		CSM	
	P	D	P	D	P	D	P	D	P	D
Milk yield, kg/d	9.80 ±2.95	10.46 ±2.78	11.05 ±3.21	12.08 ±4.55	9.08 ±2.16	10.11 ±2.53	9.76 ±1.78	10.77 ±2.15	11.76 ±2.80	13.06 ±3.10
3.5% FCM, kg/d	10.75 ±1.80	11.99 ±2.10	11.94 ±2.80	13.97 ±2.25	10.26 ±2.30	11.75 ±2.40	10.56 ±2.15	12.34 ±2.90	10.90 ±2.65	12.63 ±3.40
Fat, %	4.1	4.4	4.0	4.2	4.3	4.5	4.0	4.4	3.05	4.20
Protein, %	3.3	3.4	3.2	3.3	3.2	3.3	3.2	3.3	3.20	3.30
Lactose, %	5.1	5.1	5.0	5.0	5.0	5.0	5.1	5.0	4.90	5.00
Solids-not-fat, %	9.1	9.2	8.8	9.0	8.8	9.0	9.0	9.0	8.85	8.90
Total solids, %	13.2	13.4	12.8	12.8	13.1	13.3	13.0	13.4	11.90	12.65

* Three farms within each group, 30 farms in all, with similar lactation and condition were randomly selected for these values.

P=pre-trial; HQFB=high-quality feed block; D=during trial HQFB=high-quality feed pellet; DCL=dried cassava leaf; DLL=dried leucaena leaf; CSM=cottonseed meal.

on fat level, increase of fat percentage did benefit the farmers on their income return. Considering the high temperature and scarcity of green forage crops, the use of urea-treated rice straw and the feed supplements could offer efficient feeding systems easily practiced by the farmers. As observed by the farmers and shown on records, feeding of urea-treated rice straw and the supplements resulted in more consistent milk yield and quality than during the wet season. The significant outcome was the economical return since the use of concentrate to milk yield ratio was reduced to 1:3 or lower. Moreover, the persistency of milk was found by the farmers to be higher during this period. As can be seen in figures 1, 2, 3, 4 and 5, all milking cows which received these strategic supplements exhibited consistent milk production levels, and for some the increasing trends were observed during the research and demonstration trials.

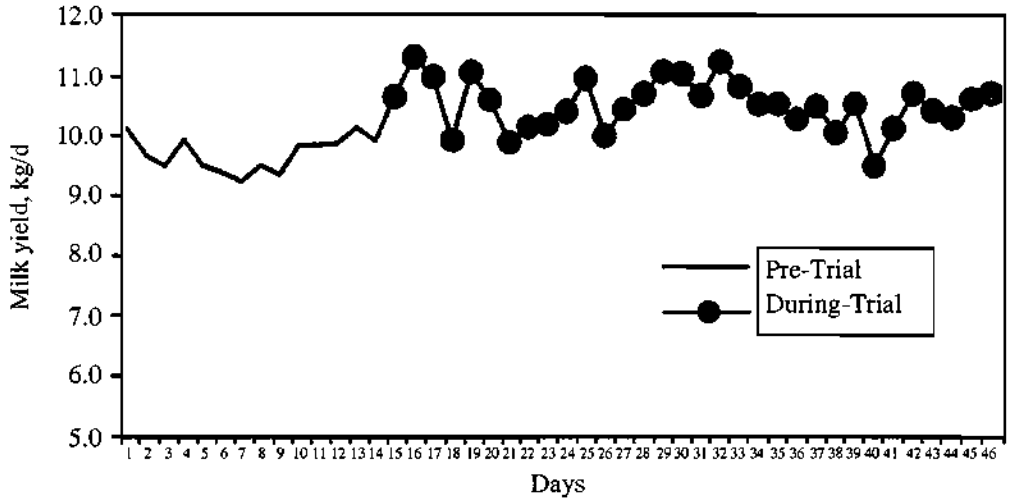

Figure 1. Effect of high quality feed block (HQFB) supplementation on milk yield in the research and demonstration trial

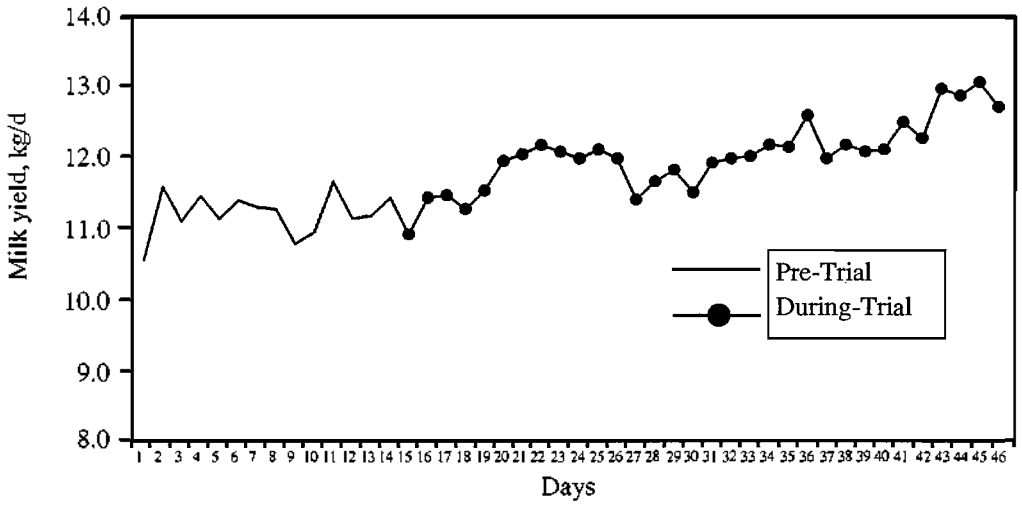

Figure 2. Effect of high quality feed pellet (HQFP) supplementation on milk yield in the demonstration trial

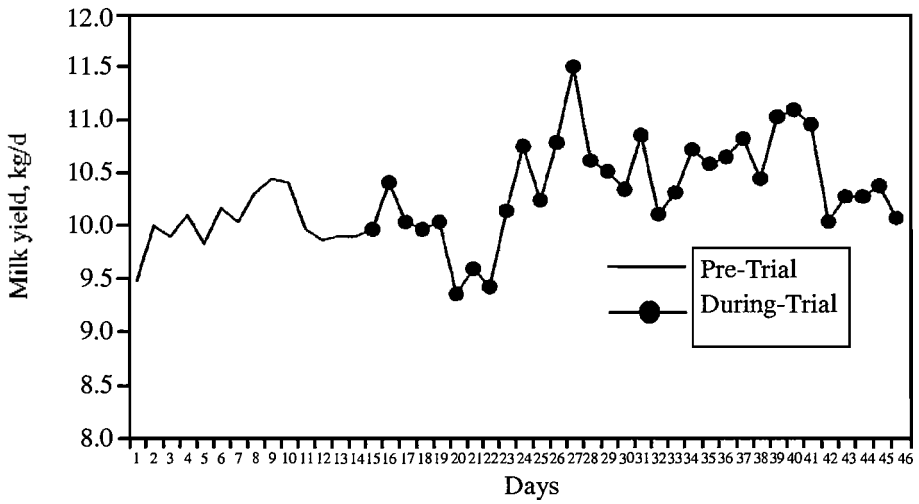

Figure 3. Effect of cassava leaf supplementation on milk yield in the research and demonstration trial

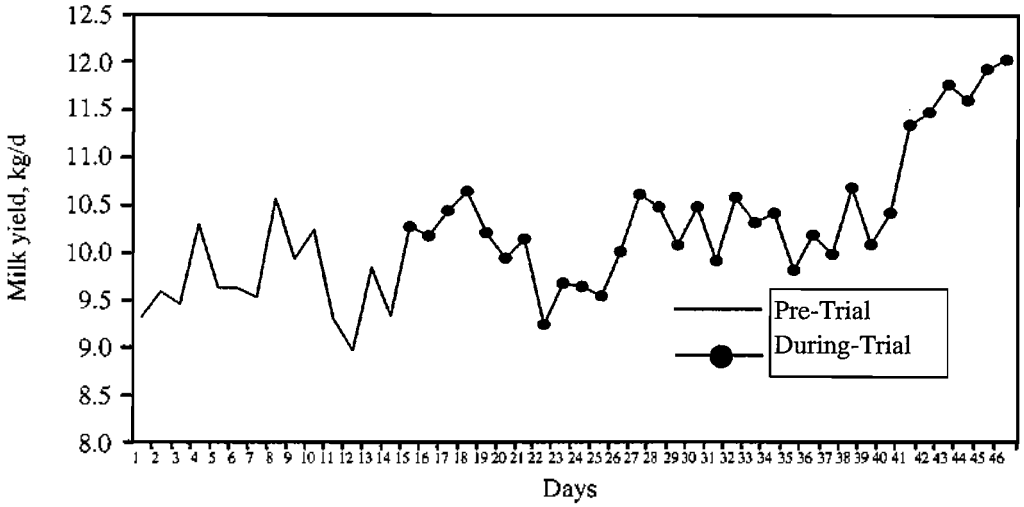

Figure 4. Effect of dried leucaena leaf supplementation on milk yield in the research and demonstration trial

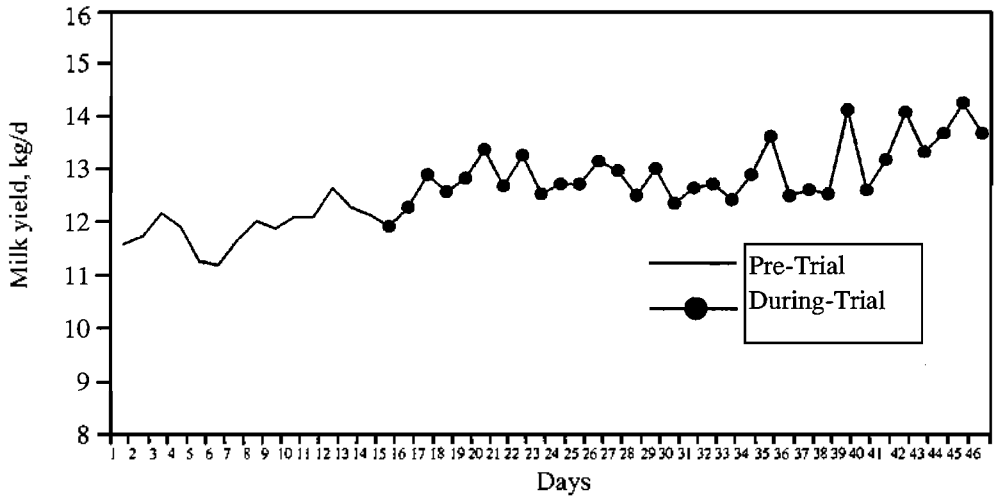

Figure 5. Effect of cotton seed meal supplementation on milk yield in the research and demonstration trial

Farmers, researchers and extension officers interactions and knowledge perception

As reported, the whole process of this demonstration of feed scheme was carried with combination of trainings/workshops and site-visits among the researchers, extension officers, and farmers which offered great opportunity for interactions, experience exchanges and efficient knowledge transfer process since all of these were carried out at University, research station, on farmers own farms and on-site visits. By working together, the farmers gained better understanding and actually worked on the feeds themselves more efficiently. On-site visits enabled other farmers to interact among themselves and offered opportunity for farmers to teach and transfer their own experiences to others under natural on-farm environment. When questions and suspicions were addressed, actual situations on farms could be used and discussed further. This was a great and efficient procedure in demonstrating and transferring potential feed supplements to dairy cows for efficient productivity and a more sustainable system.

CONCLUSIONS AND RECOMMENDATIONS

The major problems affecting and limiting efficient dairy productivity under the smallholder-farming context has been feed resources availability and quality, feeding methods and feed reserves. These factors could be minimized and achievable by establishment of on-farm feed resources. Training sites should be integrated among University or research

station, demonstration sites and on-farms which would offer comprehensive, interactive and practical perspectives under natural dairy farming environment. The participation scheme which involved farmers in the process was highly effective and facilitated practical acceptance by the engaged farmers. During the dry season, a scarcity of conventional feeds is prevalent. The use of local feeds, on-farm established feeds and seasonal crop-residues, e.g. urea-treated 5% rice straw, dried cassava leaf/cassava hay (whole crop), dried leucaena leaf, cottonseed meal, high- quality feed block/pellet, resulted in improve milk yield and quality, dairy cow condition and other performance particularly to enhance economical return by increased efficiency and lower level use of concentrate supplementation from 1:2 to 1:3 conc.:milk or lower. Most importantly, this participation scheme would establish a more self-sufficient of feed use which would lead to more sustainable smallholder dairy farming. Although, all feed supplements were efficient, the establishment and production of cassava hay on farms deserves more attention and warrants a wider development among dairy, beef and buffalo raising farmers.

ACKNOWLEDGEMENTS

We would like to express our most sincere to a number of organizations and their staff members who worked and supported the demonstration trials which have made this study most interactive and successful; the Dairy Farming Promotion Organization (DPO) of Thailand, the Northeast Region Mr. Semsak Sribantao, Mr. Sumeth Pathumsuwan, Mr. Narong Wongnen, and the Heads of Milk Collection Centers, the Provincial Livestock Offices Region 4 and their staff members. The full financial support from the Food and Agriculture Organization of the United Nations. (FAO) under the TCP/TH/ 6611 Project, the full and active participation of all of the farmers in the scheme are gratefully acknowledged. A special thank is also extended to Professor Ron Leng who served as a FAO Consultant during the demonstration and developmental trials.

REFERENCES

Hart, F. and M. Wanapat. 1992. Physiology of digestion of urea-treated rice straw in swamp buffalo. Asian-Aus. J. Anim. Sci. 5:617-622.

Wanapat, M. 1983. Supplementation of dried cassava leaves to urea-ensiled rice straw for water buffaloes. In: Proc. The 5th World Conference on Animal Production, August 14-19, 1982. Tokyo, Japan. Japanese Society of Zootechnical Science, Tokyo, Japan.

Wanapat, M. 1990. Nutritional Aspects of Ruminant Production in Southeast Asia With Special Reference to Thailand. Funny Press, Ltd., Bangkok, Thailand.

Wanapat, M., O. Pimpa, A. Petlum and U. Boontao. 1997. Cassava hay: A new strategic feed for ruminants during the dry season. Livestock Research for Rural Development. Volume 9(2).

Wanapat, M. and K. Sommart, 1993. Supplementation of high quality feed block (HQFB) for swamp buffalo fed rice straw based diets. In: Proc. The 7th World Conference on Animal Production. Edmonton, Alberta, Canada. VIII. 205-206

Wanapat, M., K. Sommart, P. Ajsuk, C. Wachirapakorn and W. Toburan. 1992. Effect of high quality feed block supplementation on intake, ruminal fermentation pattern, degradability in ruminants fed rice straw based-diets. The 30th Annual Meeting, Kasetsart University, Bangkok, Thailand.

Wanapat, M., K. Sommart, O. Pimpa and S. Boonsom. 1996. Supplementation of high quality feed pellet to increase milk productivity at small-holder farmers level. Proc. The 8th AAAP Animal Science Congress. Japanese Society of Zootechnical Sci., Tokyo, Vol 2:158.

Wanapat, M., A. Petlum, O. Pimpa, K. Sommart, C. Wachirapakorn and U. Boontao. 1997. Study on dairy cattle population and production scenerio in the NE, Thailand. Faculty of Agriculture, Khon Kaen University, Thailand.

Wanapat, M., O. Pimpa, A. Petlum and U. Boontao. 1997. Cassava hay: A new strategic feed for ruminants during the dry season. Livestock Research for Rural Development. 9(2): LRRD Home Page.

Wanapat, M., T. Puramongkon and W. Siphuak. 2000. Feeding of cassava hay for lactating dairy cows during the dry season. Asian-Aus. J. Anim. Sci. (In press).