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Comparative Study Between Indigenous and Exotic Muzaffarnagari Cross-Breed Sheep under Rural Production System in Bangladesh

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Abstract: The study aimed to assist better sheep production through comparing management, breeding system and constraints between management, breeding practices and constraints. The data of Jamuna basin indigenous (n = 40) and Muzaffarnagari cross-breeds (n = 15) sheep households were collected following the questionnaire with several visits. Flock size and ewe's percentage was higher (64.07±4.60 vs. 9.18±0.73 and 68.63 vs. 53.68%) in Muzaffarnagari cross-breed farms while breeding rams and lambs percentage were higher (10.35 vs. 2.58% and 37.60 vs. 28.79%) in Jamuna basin indigenous farm. Kucha houses with earthen floors and semi-pacca houses with slats over the concrete floor were used for sheep households of Jamuna basin indigenous and Muzaffarnagari cross-breeds sheep. Including pasturing and grazing, 40 vs. 66.7% and 40 vs. 66.7% of farmers provide supplements in their Jamuna basin indigenous and Muzaffarnagari cross-breed sheep, respectively. Free mating was common practice with unselected flock-born rams (60%) in Jamuna basin sheep farms, whereas 100% of farmers went for rams selection in purchasing (60%) and flock born in Muzaffarnagari cross sheep farms. Diarrhea with a dog bite and parasitic infestation was remarkable constraints. Long-term commitment in farming, motivation, ram selection, selective or controlled breeding and constraints improving efforts may increase sheep production in studied areas.

INTRODUCTION

Livestock is produced in the intricate agricultural systems of Bangladesh. Farmers keep sheep and goats along with a considerable number of cattle. Bangladesh Economic Review reported, livestock contributes around 3% of the national GDP and provides 15% of total employment. About 75% of people of Bangladesh rely on livestock for their livelihood of which 50% is indirectly and 20% is directly employed. Bangladesh possesses

35.37 million sheep and stands as third in number after cattle and goat population[1]. The sheep production in Bangladesh is mainly based on indigenous breeds, countrywide thinly distributed except for a relatively higher concentration in several agro-ecological zones such as coastal regions, barind tracts, North-Eastern wetlands, Sundarbans-delta regions and Jamuna river basin areas[2]. The Bangladeshi sheep are generally grouped as Coastal, Barind and Jumna basin indigenous. Among them, Jumna basin indigenous had better reproductive performance in intensive management and production systems[2]. They are mainly meat-type small-sized sheep. Nowadays, an exotic Indian Muzaffarnageri cross-breed sheep are being very popular to farmers of some western districts lie principally in Meherpur, Chuadanga and Chapainawabganj. This is also a meat-type medium-sized sheep and is pick-upping in a fewer number by the farmers of other districts for their profitable growth and weight.

Sheep households have meat, fiber, manure and cash income from their farms. Sheep are beneficial in shorter production cycles, faster growth rate, ease of management and low initial capital investment compared to large ruminants such as cattle[3, 4]. They are efficient meat producers with small space and feed. Marginal lands and crop residues can be utilized properly by keeping sheep. A farm owner or a family member can take-care of sheep gives another benefit of sheep production. Furthermore, sheep provide direct cash income and social security to farmers in the bad crop years[5]. They are also the sources of foreign currency in the large-scale production system[6]. Genotype character, animal health, environmental stresses, feed shortage in quality and quantity attribute to the reduced productivity[7]. Poor veterinary services further worsen the situation. Disease information and causes of mortality are to be supportive to survival as well as productivity. Many opined that by identifying management factors and targeting specific causes, mortality can be minimized[8]. Proper housing, nutrition and health care are important tools in reducing the death loss of small ruminants, especially lambs or kids and making production sustainable and profitable[9]. Shelter floor is associated with thermal conductivity, contamination, foot and other diseases, adverse behavior of animals[10]. Profitable animal production is, therefore required a comfortable shelter floor.

Several researchers[11-13], although, reported on the feeding nature of Bangladeshi indigenous sheep, detailed sheep feeds and feeding status at household's level is needed to be known for a better strategic program of sheep improvement and production. Likewise, studies on diseases and disease problems are scarce, to be known for better production. To date, sheep breeding for improvement is given very little attention in Bangladesh. The primary awareness step of sheep breeding for genetic improvement has recently been taken by the Bangladesh Livestock Research Institute and Department of Livestock Services[12]. Assisted Reproductive Technologies (ARTs), although are developed in the Bangladesh Agricultural University (BAU), Mymensingh as for transfer high-quality genetic merits but not yet piloting. Moreover, the valuable germplasm is still being neglected[12].

Sheep production is not up to the mark for lacking appropriate management, operational information and taking efficient steps accordingly in the rural production system. Therefore, the present study was targeted to compare indigenous (Jamuna basin) and exotic Muzaffarnagari cross-breed sheep through changing and up-scaling attitudes towards management, breeding, health and constraints for better sheep production.

MATERIALS AND METHODS

Study site: The study conveyed purposively at different sheep households of Tangail district (Gopalpur and Bhuapur Upazilla) and Meherpur district (Meherpur Sadar and Mujibnagar Upazilla) from October to March 2018. The above study areas were situated about 70-80 km and 410-420 km away from the research station. Gopalpur (24.5583°N 89.9167°E), Bhuapur (24.4583°N 89.8667°E), Meherpur Sadar (23.7750°N 88.6417°E) and Mujibnagar (23.39°N 88.36°E). These areas are covered by 1872 mm (Tangail district) and 1467 mm (Meherpur district) of annual average precipitations.

Selection of study area and farms: Based on the availability of Jamuna basin and Muzaffarnagari cross-sheep, the study areas were selected from Tangail and Meherpur districts, respectively. The sheep farms are selected on the random sampling method from the list of register books of the relevant upazilla livestock office.

Farm visit and data collection: Contact addresses facilitated the farmers and farm visits. An informal survey with a simple checklist type of questionnaire was used for interviewing the respondents individually. The questionnaire constituted all open types of information ranked in various scales (1, 2, 3; Yes, No). Farmer's leisure periods were a choice for interviewing on farmyard or grazing fields. The farm structure, flock size, male selection, breeding practice, nutrition, management, disease, prevention and treatment, major production constraints included in interviewing the farmers. While most of the information was provided by the farmers, housing conditions and feeding systems were subjectively evaluated by the researcher.

Data analysis: Collected data were tabulated first in the Excel sheet. The frequency and descriptive statistics of Statistical Package for the Social Sciences (SPSS ver. 22) were used to analyze the data.

Table 1: Flock size and composition of sheep in study areas

Sheep categories	Sheep Households (n = 55)							
	JBI sheep farm owner (n = 40)				MZN cross sheep farm owner (n = 15)			
	n	Mean ±SE	Range	Total flock (%)	n	Mean ±SE	Range	Total flock (%)
Mature Ewe	197	4.93±0.36	3-15	53.68	665	44.33±3.9	25-76	68.63
Breeding rams	38	0.95±0.12	0-2	10.35	25	1.67±0.19	1-3	2.58
Lambs (weaning)	138	3.45±0.39	1-14	37.60	279	18.60±1.39	9-28	28.79
Total	367	9.18±0.73	5-30	100	969	64.07±4.60	35-96	100

Table 2: Types of house and shelter of sheep at night in study areas

Items	Sheep Households (n = 55)			
	JBI sheep (n = 40)		MZN cross sheep (n = 15)	
	Frequency	Percentage	Frequency	Percentage
House position				
Separate house	6	15.0	15	100
Common house of other livestock	21	52.5	-	-
Extended house/Veranda	13	32.5	-	-
House types				
Kutcha	40	100	-	-
Semi-Pucca	-	-	15	100
Floor-type				
Earthen	39	97.5	-	-
Slat over earthen	1	2.5	3	20
Slat over concrete	-	-	12	80

JBI = Jamuna Basin Indigenous; MZN = Muzaffarnagari

RESULTS

Flock size and structures: The average flock size and composition of Jamuna Basin Indigenous (JBI) and Muzaffarnagari (MZN) cross-sheep are presented in Table 1. The results obtained from the present study showed that per household flock size was larger (64.07±4.60, range of 35-96) in MZN cross-breed sheep than JBI sheep (9.18±0.73, range of 5-30). Flock composition in terms of ewe, ram and lamb were 4.93±0.36 vs. 44.33±3.92, 0.95±0.12 vs. 1.67±0.19, 3.45±0.39 vs. 18.60±1.39 between two studied breeds, respectively. Mature ewes were higher (68.63%) in MZN cross-breed sheep than JBI (53.68%) sheep flocks. On other sites, breeding rams and lambs values were higher (10.35 and 37.60%) in JBI sheep than MZN cross-breed sheep flocks (2.58 and 28.79%), respectively.

Housing system: Sheep housing and sheltering for studied two breeds are presented in Table 2. The results indicated that most of the JBI sheep farmers (52.5%) keep their animal's in the common sheltering houses of other animals, 32.5% in the extended family house (Varanda) and only 15% of farmer's kept in separately build a house. They had all Kucha houses (Fig. 1a) with mostly (97.5%) earthen floor without any slat. All households of MZN cross sheep sheltered their animals in separately built semi-pucca houses (Fig. 1b) where 80% of the house had slat over the concrete floor and 20% had slat over the earthen floor.

Feed resources and feeding: Jamuna Basin Indigenous (JBI) and Muzaffarnagari (MZN) cross sheep feeds and feeding are presented in Table 3. In both study areas, farmers fed their sheep on natural pastureland, fellow land, tree leaves or forage, road or riverside grass and crop residues (Fig. 2a,b).

About 40% of the households in Jamuna basin areas supplement their sheep in the leisure period as rice or wheat bran (52.5%), mineral/salt (22.5%). On other sites, 66.7% of farmers use supplement feeds to their sheep with rice straw (46.7%), rice/wheat bran (53.3%), maize crush (46.7%), mineral/salt (60.0%) and vitamin (33.3%) for MZN cross sheep breed. In both study sites, 55 vs. 80% farmers of JBI and MZN cross-breed sheep farms, respectively allowed to graze their sheep for 8-10 h and 45 vs. 20% farmers for 10-12 h. About 100% of farmers in Jamuna basin areas were found to contribute their sheep themselves while 73.3% of farmers and 26.7% of employers contributed MZN cross-sheep in Meherpur areas.

Breeding practices: Controlled mating was not followed in the studied sheep breeds farms, thus showed about 100% of free mating in the flocks (Table 4).

About 60 vs. 40% of farmers bred ewes with their breeding rams (Fig. 3a) and 2.5 vs. 60% with purchased rams in JBI and MZN cross-breed sheep farms, respectively. About 37.5% of households get their ewes serviced with rams from their neighbors in common grazing areas in JBI sheep farms only. What a ram

(a) (b)

Fig. 1(a, b): (a) Jamuna basin indigenous sheep and raw housing and (b) Exotic Muzaffarnagari cross-breed sheep and semi-concrete slat housing

(a) (b)

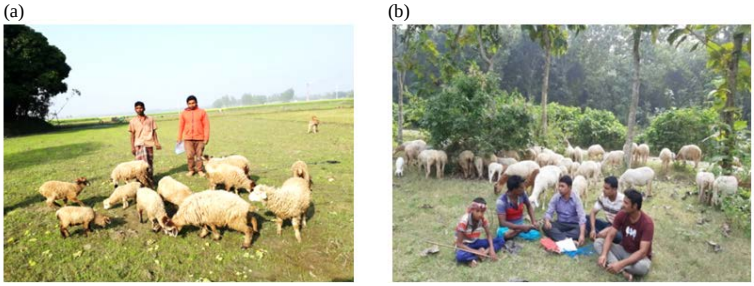

Fig. 2(a, b): (a) Jamuna basin indigenous sheep at crop-harvested grazing field and (b) Exotic Muzaffarnagari cross-breed sheep at natural grazing pasture

(a) (b)

Fig. 3(a, b): (a) Flock born or neighborhood indigenous breeding ram and (b) Selected Exotic Muzaffarnagari cross-breed breeding ram

Table 3: Feeds and feeding of sheep at study areas

	Sheep Households (n = 55)			
	JBI sheep farm (n = 40)		MZN cross sheep farm (n = 15)	
Items	Frequency	Percentage	Frequency	Percentage
Feed sources				
Nature pasture land	40	100	15	100
Fellow land	40	100	15	100
Tree leaves/forages	40	100	15	100
Road/river side	40	100	15	100
Crop residue	40	100	15	100
Supplements				
Yes	16	40	10	66.7
No	24	60	5	33.3
Types of supplements				
Rice/wheat bran	21	52.5	8	53.3
Rice straw	-	-	7	46.7

Table 3: Continue

	Sheep Households (n = 55)			
	JBI sheep farm (n = 40)		MZN cross sheep farm (n = 15)	
Items	Frequency	Percentage	Frequency	Percentage
Maize grain/crush	-	-	7	46.7
Salt/minerals	9	22.5	9	60.0
Vitamins	-	-	5	33.3
Time of grassing				
8-10 h	22	55	12	80
10-12 h/down to dusk	18	45	3	20
Sheep contributor				
Farmer himself	40	100	11	73.3
Employee	-	-	4	26.7

Table 4: Breeding practices prevailed in field sheep production

	Sheep Households (n = 55)			
	JBI sheep farm (n = 40)		MZN cross sheep (n = 15)	
Items	Frequency	Percentage	Frequency	Percentage
Source of breeding rams				
Home breed/own	24	60.0	6	40.0
Neighbors	15	37.5	-	-
Purchase	1	2.5	9	60.0
Selection of ram for breeding				
Yes	-	-	15	100.0
No	40	100.0	-	-
Criteria for ram selection				
Body conformation	-	-	15	100.0
Mating systems				
Free mating	40	100.0	15	100.0
Controlled mating	-	-	-	-

JBI = Jamuna Basin Indigenous; MZN = Muzaffarnagari

Table 5: Common sheep diseases and health practice in the study areas

	Sheep Households (n = 55)			
	JBI sheep (n = 40)		MZN cross sheep (n = 15)	
Items	Frequency	Farm (%)	Frequency	Farm (%)
Diseases				
Diarrhoea	24	60	8	53
Dysentery	6	15	1	7
Pneumonia	15	38	1	7
PPR	8	20	-	-
Parasite/bottle jaw	2	5	7	47
Bloat	5	13	1	7
FMD	1	3	6	40
Tetanus	-	-	2	13
Allopasia	3	8	-	-
Rabies/Dog bite	12	30	-	-
Measures are taken when sick				
Take local treatment	29	72	5	36
Take Veterinary treatment	11	28	9	64
Use of vaccine				
Yes	5	13	12	80
No.	35	87	3	20
Use of deworming				
Yes	5	13	15	100
No.	35	87	-	-

JBI = Jamuna Basin Indigenous; MZN = Muzaffarnagari; PPR = Peste des Petits Ruminants; FMD = Foot and Mouth Disease

sources, 100% of MZN cross-breed sheep households were found to select breeding rams (Fig. 3b), mainly on the body conformation. Breeding ram selection was not in practice for JBI sheep households.

Disease prevalence and health management: The major diseases and health management of two sheep breeds in the studied areas are presented in Table 5. The common disease occurrences of dysentery, pneumonia, diarrhea, tetanus, Peste des Petits Ruminants (PPR), Foot and

Table 6: Constraints of field sheep production in study areas

	Sheep Households (n = 55)			
	JBI sheep (n = 40)		MZN cross-sheep (n = 15)	
Constraints	Frequency	Percentage	Frequency	Percentage
Diseases	36	90.0	4	26.7
Parasite	1	2.5	7	46.7
Pastureland	-	-	2	13.3
Shed problem	3	7.5	1	6.7
Treatment	-	-	1	6.7

JBI = Jamuna Basin Indigenous; MZN = Muzaffarnagari

Mouth Disease (FMD), dog bite (Rabies) and alopecia were between two breeds (researcher observation). According to the respondent, diarrhea, pneumonia, rabies (dog bite) and PPR were the most occurrence (60, 38, 30 and 20%, respectively) diseases in JBI sheep farms, on the opposite, diarrhea, parasite, FMD occurred (53, 47 and 40%, respectively) in MZN cross-breed sheep farms. When animals got sick, most households (72%) took local advice in JBI sheep; it is almost the opposite in MZN cross-breed sheep households whereas, 64% of farmers took veterinary advice for their animals. The farmers of the Jamuna basin areas of Tangail district had little access (13%) and Muzaffarnagari cross-sheep farmers in Meherpur district had higher access (80.0 and 100.0%) to vaccination and deworming program.

Constraints of sheep production: Table 6 represents overall constraints between two sheep in the study areas. These constraints as reported by the respondents were a disease, parasite, pasture land, shed problem and treatment as 90.0 vs. 26.7%, 2.5 vs. 46.7%, 0 vs. 13.3%, 7.5 vs. 6.7%, 0 vs. 6.7%, respectively in JBI and MZN cross sheep farms. As a statement of the report, disease and parasite were mostly affecting constraints in JBI and MZN cross-sheep farms, respectively.

DISCUSSION

Flock size and composition is an important indicator of a management system that exploits some degree of management, constraints and productivity[14]. In the present study, comparatively, increased flock size per family in Meherpur district indicates that the area favors MZN cross sheep breed, the higher dependency of farmers on sheep, the higher chance of success in productivity with minimum constraints and acceptance of village-level sheep breeding strategy if planned. The flock size of Horro and Adiyo Kaka sheep (8.20±2.05 and 11.3±1.27%, respectively congregated with the values with JBI sheep flock size[15]. The current flock size of MZN cross sheep was also larger than the flock size of Menz sheep (31.45%) in the cool highlands of Ethiopia[16].

The current proportion of ewes and rams in JBI sheep farms were in agreement with the previous findings of 54.2 and 15.6%[17] where findings in MZN cross sheep farms were in line with a female[18] and male[17] mature sheep (70 and 2.4 %), respectively. The large proportion indicates that owners or farmers of both types of sheep breeds flocks in both study areas maintain breeding ewes for a long period and the importance of culling is not fully recognized. This confirms by similar studies in southern and southwestern Ethiopia irrespective of differences in a production system and resource[19-21]. The ram to ewe ratios were 0.20 and 0.04 for JBI and MZN cross sheep, respectively. The ratio for JBI sheep-raising areas was higher than the recommended breeding ratio for small ruminants. Smaller flock size and farm specificity might of the reason of occurring the differences. This also exploits that the farmers in this site are not aware of or do not follow the proper breeding system. The male to female sex ratios of MZN cross-breeds were similar to the recommended sex ratio (1:25) under the traditional production system[22]. This presents farmers are of this site very conscious of proper breeding system.

Housing makes easy management, reduce animal stress and disease hazard with the increased productivity. Farmers house their sheep at night to a shelter from theft, predators and environmental changes in both study sites. This is in agreement with reports of Shenkute *et al*.[23] and Fikru and Gebeyaw[24]. Jamuna basin sheep are mostly kept in a common house together with other livestock, locally called the kutcha house (a temporary house is made of tin, bamboo, mud and other materials with earthen floors) and the next confined house was Varanda (a barn constructed as an expansion of the main family houses). These might be due to smaller flock size and the diseases and disease conditions may favor the sheep. These types of adjoining houses were also observed by Samuel[25], Assefa[19] and Kocho and Geta[20]. The farmers confined their MZN cross sheep mostly in separately build the semi-pucca house (made of tin, breaks, rods and cement with or without a concrete floor). This might be due to the larger flock size and this can make the management easier. Shenkute[21] also reported separate houses of sheep sheltering in his study in the Goma district of Southern Ethiopia.

Feeds and feeding is the basic factor of animal production. Mainly roughage and concentrate constitute the feeds of the small ruminant. Natural pasture, fellow land, crop residue, river/roadside pasture, tree leaves, forage and fodders are the common resources of roughage. According to the current study, farmers (100%) opined that their sheep take this roughage during pasturing on availability in various amounts all the year-round irrespective of season in both study sites. The report of Islam *et al*.[26] was in agreement with the present study that stated as 96.90-100% of farmers fed tree fodder and green grass to their coastal indigenous sheep of Bangladesh. Banerjee[13] and Islam *et al*.[27] also stated Bangladeshi indigenous sheep as efficient use of these roughages. Bangladeshi sheep farmers use wheat bran, rice bran or polish, khesari bran, maize or maize crush, til oil cake, mustard oil cake, broken rice, rice straw, salt as supplement feeds for a small ruminant. Supplementations varied in both study areas and might be due to farmer's status, flock size, shortage of feed. In supplemented farms of Jamuna basin areas in the Tangail district, farmers commonly used rice gruel or rice bran or wheat bran and salt only. The sheep farmers of the Meherpur district used wheat or rice bran, maize crushes, salt and rice straw (locally called Bichali) supplements to their farms. Generally, the women member of the family was employed to sheep rearing in Jamuna basin farms. In some farms (45%), sheep became free of confinement in the morning and started roaming and grazing up to dusk (10-12 h). In other farms (55%), sheep were confined again for few hours into another confinement in the yard and then they allowed grazing up to evening (8-10h). These findings were in agreement with Islam *et al*.[27] who stated that about 43% of the farmers of the coastal area of Bangladesh graze their sheep from dawn to dusk while 40% graze for 10 h and 13% graze for 12 h only. MZN cross-sheep was found to be confined in an en-closer on the yards for few hours. Then farmer himself or an employee took them out for grazing; it was 9:00-5:00 pm (8-10 h, 80%) in most cases or up to dusk (10-12 h, 20%).

Breeding with high genetic merit can increase productivity; therefore, selection and source of sire together with controlled or uncontrolled mating are of outstanding importance inbreeding. According to the current study, the farmers of JBI sheep farms in the Tangail district were not adapted with a controlled mating system and selection of breeding ram. Castration was an uncommon practice and different aged homebred rams run together with ewes throughout the year. Farmers who had no breeding rams, ewes got service from similar neighborhoods rams. They sometimes purchase ram from the local market. This type of breeding was also reported by Falconer[28], Ndamukong *et al*.[29] and Kosgey *et al*.[30]. Therefore, inbreeding prevailed in these smaller sheep flocks. Small flock size and inbreeding potentially were also indicated by Seleka[31]. The uncontrolled mating was observed in MZN cross sheep production systems in Meherpur district with flock born and purchase rams. In both cases, farmers went for ram selection on the base of body conformation. As per the farmer's points, flock-born selected rams are being changed after two years of breeding to the low level of inflow of animal inheritance for inbreeding.

The disease is the main bottleneck of the production system as it pertains to farmer's economic loss in consequence of animal treatment and transport cost, weight loss and in some cases, total animal loss. Therefore, it is important to know the disease condition of an area to provide intervention for hindrances of the production. Disease occurrence in livestock is a common phenomenon and reported for many years by researchers[20, 31, 32]. In both study sites, diarrhea was the most common occurrence. Pneumonia and rabies (dog bite) were most prevalent in the JBI sheep farms, on other sites, parasites and Foot and Mouth Disease (FMD) in MZN cross sheep farms were most prevalent along with other common diseases. These variations might be due to flock size and management practices of respective sheep farm owners. The MZN cross sheep farmers were found more conscious of the prevention and treatment of diseases than JBI sheep owners. They mostly took veterinary advice in treating the sick animals and more deworming and vaccination programs. Improved sheep genetic and farmer's livelihood, literacy in Meherpur districts might be of the reason. Oppositely, the poor and marginal farmers of Jamuna basin areas had rather access to local treatment with very little or without disease prevention measures.

Farmers in the Jamuna basin areas of Tangail district did not experience well in constraints like pasture land (food shortage), shed problem, parasitic infestation and type of proper treatment. This might be because of a lack of farmer's awareness of their smaller flock size. On this site, farmers explained diseases like diarrhea and rabies (dog bite) were their main constraint of sheep production. These might be due to proper management and care. The farmers also did not make familiar their sheep with domestic dogs to avoid a dog bite injury and death. Although the farmers did not bring out, the genotype was a problem in Jamuna basin areas (researcher observation). Farmer's ignorance of selective breeding with high productive breeds might because of breeding constraints. In the Meherpur district, farmers complained about disease and parasites as their main constraints of sheep production. They were experienced mostly in constraints of FMD and liver fluke in their sheep. These might be because of low pasturing lands, genotype and geographical attributes.

CONCLUSION

Sheep production could be improved with the avoidance of inbreeding with flock born or neighborhood ram. Therefore, a participatory flock improvement for strategic breeding programs among sheep keepers should be carefully designed with the aim of farmers' need using selective breeding with high-quality genotype. Natural pasturing for long-duration may reduce supplement feed cost and reserve household funds. The major constraints disease and parasites, should be furnished to improve and increase sheep production. Farmer's awareness concerning proper deworming with the selective anthelmintic and proper way of treating the disease increase production by saving the farmer's income.

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