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Farmers' preferences towards Quality Protein Maize (QPM) Varieties for Feed and Fodder in Middle Hills of Nepal

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ABSTRACT: Quality protein maize (QPM) compared to normal maize is useful not only for food and nutritional security to humans but also for feed and fodder security to livestock. Five QPM varieties including farmers' local were evaluated at four and eight sites in Arghakhanchi, Dailekh, Dang and Surkhet districts using mother-baby and minikit scheme during summer season of 2013 and 2014, respectively to identify their usefulness for feed and fodder to livestock. Feedbacks from babies and minikits were collected through household level questionnaire. Most of the respondents preferred QPM varieties compared to locals because of thicker stalk, stay green character and higher stalk production, and stalk liked by animals. Supplying green fodder at silking to grain filling stage of a QPM variety Poshilo Makai-1 increased milk yield from 12 to 25 percent compared to other fodders.

KEYWORDS: Quality Protein Maize, Genotype, Fodder, Milk, Yield.

I. INTRODUCTION

Maize is the third most important cereal in the world. Asia consumes more than 62 percent of the maize production in the form of animal feed and the remaining for human consumption [18]. Maize is the main feed ingredient for animals (pigs, cattle, poultry and fish) as it is high in energy, low in fibre and easily digested by most livestock species. Its endosperm, containing approximately 9-12% protein is, however, deficient in two essential amino acids viz. lysine and tryptophan. This leads to poor net protein utilization and low biological value of normal maize [8].

The increasing use of maize for feed in less developed countries, many of which have to import protein concentrates for feed industries, the substitution of QPM for normal maize could lower the cost of feed rations [1]. QPM plays an important role in livestock production where soybeans and fishmeal are expensive or unavailable. As reported by Vasal [20], Gevers in 1989 indicated that the use of high lysine maize (HLM) in monogastric animals' feeds and its direct industrial exploitation could offer greatest immediate rewards. It was shown that 22% of fishmeal normally used in pig diets could be saved due to the increased lysine content of HLM. The savings in the cost of producing feed from using QPM was 4–5% for pig feed and 3–4% for poultry feed in Brazil, and 3–4% for both pig and poultry feed in El Salvador [12, 13]. Feeding QPM to weaner pigs at 72.3% inclusion level could result a higher food conversion efficiency and reduced cost of production [16]. In Kenya, 5% cost reduction in poultry feed was recorded by using QPM instead of normal maize [6]. In Guatemala, chicks fed with QPM from age 15 days to age 5 weeks had gained 446 g, whereas chicks fed with normal maize or sorghum had gained only 223 g and 195 g, respectively. Similarly, pigs fed with QPM diet gained 256 g per day, while the animal fed with normal maize gained an average of 21 g per day [14]. De-Quan and Shi-Huang [7] also observed 29.8% more daily weight gain in pigs fed with QPM compared to normal counterpart. Pigs and chicken raised on QPM gain weight at roughly twice the rate of animals fed on normal maize [2, 3, 5, 19]. Maize is free from anti-nutritional components, quick growing, higher biomass yields and highly palatable [22]. Green forage of maize containing stalks, leaves and ears, is an energy-rich fodder for ruminant livestock. Fresh biomass yields of maize green fodder range from 10 to 50 t ha^{-1} [9]. QPM made chickens laid more eggs in Nicaragua [4] and China [11].

II. MATERIALS AND METHODS

Five QPM varieties namely S99TLYQ-B, S99TLYQ-AB, S03TLYQ-AB-01, S03TLYQ-AB-02, Poshilo Makai-1 and farmers' local were experimented under mother-baby scheme at five and eight farmers' fields in Arghakhanchi,

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Dailekh, Dang and Surkhet districts during summer season of 2013 and 2014, respectively. A single variety (1/2-1 kg) was given to the farmer to compare it with his/her local variety under own management in baby trial (BTs). BTs were managed by farmers themselves. Seeds of a single variety were given to five farmers at a site. As there were 5 varieties, 25 farmers got seeds of these five varieties. Varieties were allocated to farmers randomly. Total 500 and 800 farmers evaluated babies in these 4 districts in 2013 and 2014, respectively. The improved variety and their local were planted in the same field in adjacent plots. They compared the performance of each improved variety with their local from planting to post-harvest management. Individual farmer reported his/her own perceptions through a household level questionnaire (HLQ) through matrix ranking. Data in HLQ was recorded as scores where the new variety was compared to their local counterpart as better (1), same (2) or worse (3). In addition to babies, in each district, 105, 108, 95, 70 and 150 sets of S99TLYQ-B, S99TLYQ-AB, S03TLYQ-AB-01, S03TLYQ-AB-02 and Poshilo Makai-1, respectively were distributed as minikit in 2013. In each district 528 minikits were distributed. Total 2112 households evaluated minikits in the project area during summer season of 2013. Number of variety wise minikits varied in different districts in 2014. 8, 28, 13, 24, 113; 7, 21, 10, 20, 81; 8, 24, 13, 26, 99; and 8, 22, 13, 29, 124 minikts of S99TLYQ-B, S99TLYQ-AB, S03TLYQ-AB-01, S03TLYQ-AB-02 and Poshilo Makai-1 were distributed respectively, in Arghakhanchi, Dailekh, Dang and Surkhet districts. Total 691 minikits were evaluated by farmers in 2014. As 500 and 800 households evaluated babies in 2013 and 2014, respectively, thus, within a two-year period a total of 4103 households evaluated various QPM varieties. Feedbacks from babies and minikits were separately collected and tabulated in 2013, whereas because of the same nature of performance evaluation of babies and minikits, farmers' feedbacks were collected through HLQ, then combined and presented in 2014.

Similarly, to get feedback from farmers regarding milk yield after feeding green stalk of QPM and normal maize, four farmers holding milch buffaloes were selected in each district. Ten kg seeds of QPM variety Poshilo Makai-1 to each farmer were provided for this purpose. They were asked to feed QPM fodder to their buffaloes during silking to grain filling stage and record the milk yield. A group discussion was held with them and their feedbacks were recorded.

III. RESULTS AND DISCUSSION

Results presented in this paper are not researchers managed and led. These are combined feedbacks from huge number of collaborating farmers from western and mid-western regions of Nepal using HLQ. We could not receive variety wise effect on milk yield. However, majority of the farmers reported increased milk yield after feeding green fodder, green bio-mass after harvest and grain as feed of QPM varieties compared to their local. Farmers in these regions preferred QPM varieties for fodder because of thicker stalk, stay green characters and more stalk production as compared to their locals. They reported that livestock preferred QPM stalk and yielded more milk when fed QPM stalk compared to their normal local variety/ies.

Combined feedbacks over locations from babies and minikits in 2013 showed that 56, 77, 76, 80 and 68% of the respondents found thicker stalk of S03TLYQ-AB-02, S99TLYQ-AB-01, S99TLYQ-B, S99TLYQ-AB and Poshilo Makai-1, respectively compared to their locals. Sixty to 89% farmers felt stay green nature of QPM varieties. Similarly, 68 to 79% collaborators reported higher stalk production of QPM varieties. More than 73% of the respondents found better preferences of livestock towards QPM stalk and stover in 2013 (Table 1).

Table 1: Farmers' feedbacks towards usefulness of QPM varieties to animals from babies and minikits in western and mid-western regions, summer 2013

	S03TLYQ-AB-02			S99TLYQ-AB-01			S99TLYQ-B			S99TLYQ-AB			Poshilo 1		
Parameter	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Stalk thickness	56*	36	8	77	12	11	76	18	6	80	14	7	68	21	12
Stay green character	60	12	28	82	11	7	81	13	6	79	13	8	89	6	5
Stalk production	78	11	10	72	11	17	68	21	11	79	18	4	73	16	11
Did livestock like this variety?	73	16	11	80	11	9	87	9	3	85	11	4	85	15	0
Milk increment after feeding	75	15	10	78	14	8	84	11	5	81	14	5	78	22	0
Total distributed (No.)	405			505			420			545			725		
Feedback received (No.)	322			334			403			391			432		
Feedback received (%)	79.51			66.14			95.95			71.74			59.59		

1: Better than local, 2: Similar to local, 3: Worse than local, *: Percent respondents supporting the point

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In 2014, 61, 54, 59, 58 and 71% of the respondents reported thicker stalk of S99TLYQ-B, S99TLYQ-AB, S99TLYQ-AB-01, S03TLYQ-AB-02 and Poshilo Makai-1, respectively compared to their locals. Fifty-six to 69% farmers added stay green nature of tested QPM varieties. Sixty-five to 73% of the respondents found better preferences of livestock towards QPM stalk and stover (Table 2). More interestingly, 75, 78, 84, 81 and 78% feedbacks showed increased milk yield of buffaloes after feeding stover and grain of QPM varieties S03TLYQ-AB-02, S99TLYQ-AB-01, S99TLYQ-B, S99TLYQ-AB and Poshilo Makai-1, respectively compared to their locals in 2013. Likewise, 32 to 46% of the respondents reported increased milk yield of buffaloes after feeding grain of QPM compared to their locals.

We collected feedbacks from the farmers growing Poshilo Makai-1 for fodder purpose to milch animals. In Arghakhanchi district farmers reported that green fodder of Poshilo Makai-1 was supplied @ 40 kg/day to milking buffalo. Milk production was increased by 12%. Milk production increment started after 3 days of continuous feeding and remained after 5 days of last feeding. Previously animal produced 2.5 L/day and after feeding 2.8 L/day. Likewise, when quantity of fodder (green biomass) was increased up to 50 kg/day, milk production was increased by 20%. Previously animal used to give 2 L/day and after feeding QPM fodder it produced 2.4 L/day.

Table 2: Farmers' feedbacks towards usefulness of QPM varieties to animals from baby trials and minikits in western and mid-western regions, summer 2014

Parameter	S99TLYQ-B			S99TLYQ-AB			S03TLYQ-AB-01			S03TLYQ-AB-02			Poshilo-1		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Stalk thickness	87** (61)*	38 (27)	17 (12)	99 (54)	49 (27)	36 (20)	93 (59)	41 (26)	23 (15)	105 (58)	48 (27)	28 (15)	318 (71)	79 (18)	53 (12)
Stay green	87 (63)	28 (20)	24 (17)	95 (56)	40 (24)	35 (21)	87 (57)	42 (28)	23 (15)	109 (63)	34 (20)	31 (18)	291 (69)	88 (21)	43 (10)
Stalk liked by animals	88 (73)	29 (24)	3 (3)	104 (66)	51 (32)	2 (1)	81 65)	40 (32)	3 (2)	110 (70)	46 (29)	2 (1)	273 (73)	100 (27)	3 (1)
Milk feeding green stalk	25 (37)	41 (61)	1 (1)	30 (30)	67 (67)	3 (3)	24 (32)	48 (63)	4 (5)	25 (26)	70 (73)	1 (1)	81 (32)	166 (66)	5 (2)
Milk after feeding QPM	32 (46)	37 (53)	1 (1)	36 (36)	64 (63)	1 (1)	31 (38)	46 (56)	5 (6)	32 (32)	66 (65)	3 (3)	88 (33)	166 (62)	12 (5)
Stalk production	47 (37)	53 (41)	28 (22)	55 (31)	85 (48)	36 (20)	56 (39)	71 (50)	16 (11)	55 (34)	76 (47)	30 (19)	144 (36)	210 (52)	50 (12)
Female	90 (54)			118 (56)			85 (48)			116 (57)			229 (48)		
Male	76 (46)			92 (44)			93 (52)			87 (43)			247 (52)		
Janjati	57 (34)			75 (36)			48 (27)			65 (32)			124 (26)		
Dalit	42 (25)			65 (31)			65 (37)			61 (30)			198 (42)		
Others	67 (40)			70 (33)			65 (37)			77 (38)			154 (32)		
T distributed	191			255			209			259			577		
T FB rec.	166			210			178			203			476		
FB rec. (%)	87			82			85			78			82		

1: Better than local, 2: Similar to local, 3: Worse than local, * *& *: Number and percent respondents supporting the point, respectively, T: Total, FB: Feedback, rec.: Received

In Dang district, farmers reported that Poshilo Makai-1 was found nutritious fodder to livestock. It was better than Nettle grass, which they considered as nutritious fodder to livestock. Fodder of Poshilo Makai-1 was more nutritious than fodder from a normal maize of multinational company hybrid "JK" and a recommended normal open-pollinated maize variety "Arun-2". Both stalk and leaves of this variety were preferred by animals. He added, generally, buffaloes used to produce 2.0 L of milk and after feeding Poshilo Makai-1 produced 2.5 L. Thus, milk production increased by 25%.

Reports from Dailekh and Surkhet districts showed 10% and 12.5% milk increment, respectively while feeding fodder of Poshilo Makai-1 to milking buffalo. Ortega and his colleagues [17] also reported increased milk production when farmers feed opaque-2 corn silage to dairy cattle. However, in the feeding and digestion trials (lactating Boran x Friesian cows) similar performance among diets of QPM and normal maize in milk yield and composition was recorded [10]. Positive effect of silage prepared from whole plant of QPM resulted on growth rate with higher carcass components yields in Arsi ram [15]. It was concluded that among the tested normal and QPM varieties' fodder, normal maize variety DHM 117 have lowest methane generation potential with no adverse effect on digestibility and suggested to use in the preparation of least methane producing ration for ruminants [21].

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IV. CONCLUSION

Based on overall feedbacks from all four districts, most of the tested QPM varieties were preferred by farmers for feed and fodder to milking buffaloes. Twelve to twenty-five percent milk yield increment was recorded by the farmers while feeding green fodder from silking to grain filling stage of a QPM variety Poshilo Makai-1.

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