Alternative feeding options to enhance dairy farm sustainability in Bangladesh

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1. Introduction

Dairying in Bangladesh

- ✓ Farmers : 1.2 million, Dairy cows: 6.14 million
- ✓ Milk shortage: 55 -60%, Feed shortage: 45%
- ✓ Imported concentrate: 80%
- ✓ Main roughages- Rice straw, Local grass and Napier
- ✓ Cropping pattern: Paddy rainfed-paddy irrigated/cash crops

Research question: What were the alternative feeding strategies to enhance dairy farm sustainability in Bangladesh?

2. Materials and methods

- ✓ Study areas: Bangladesh (Jhenaidha, Meherpur)
- ✓ Focus group discussion, Farm survey
- ✓ Farm size & number: Small(2), Medium(2), Large(
- ✓ Research tools: FEAST & FarmDESIGN
- ✓FarmDESIGN (Objectives): Operating profit ($/ha)
  OM balance(kg/ha), Self-reliance(%)
  Feed costs($/kgDM), Soil N losses(kg/ha)
- ✓Decision variables

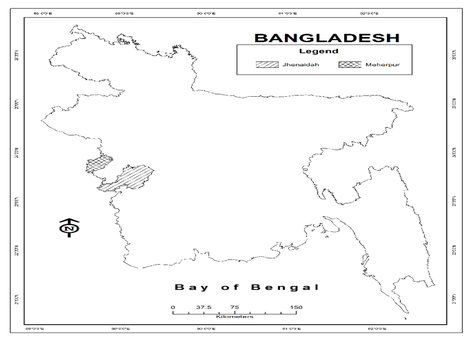


Figure 1: Map of Bangladesh

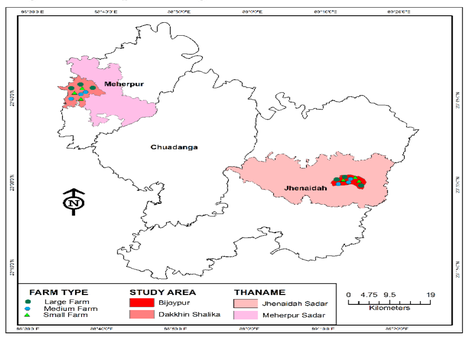
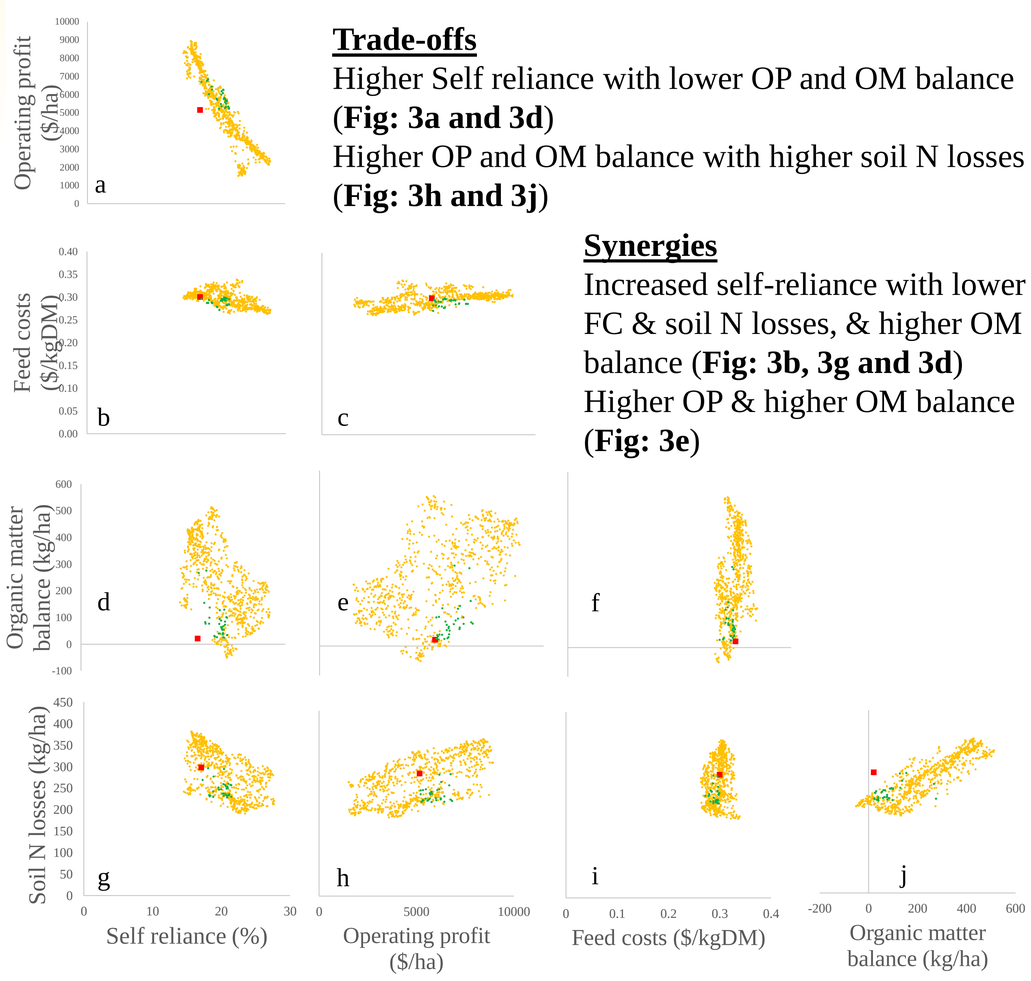


Figure 2: Map of Jhenaidha and Meherpur districts

3. Results

Table 1: Original and optimized farm performance (potential change in %) over a year by using Pareto optimum solutions

Variables/ Potential change (%)	Operating profit	Feed cost	OM balance	Soil N losses	Self reliance
J-large	14	-3	286	-17	18
J-medium	12	-16	37	-4	25
J-small	10	-6	17	-10	16
M-large	37	-10	4	-8	8
M-medium	209	-15	13	-16	21
M-small	22	-7	4	-22	7



Trade-offs

Higher Self reliance with lower OP and OM balance (**Fig: 3a and 3d**)
Higher OP and OM balance with higher soil N losses (**Fig: 3h and 3j**)

Synergies

Increased self-reliance with lower FC & soil N losses, & higher OM balance (**Fig: 3b, 3g and 3d**)
Higher OP & higher OM balance (**Fig: 3e**)

Figure 3: Pareto-optimum solutions from the J-large farm scenario

Key change:

External feed

- ✓ Decrease- wheat bran, mustard oil cake
- ✓ Increase- Napier, maize silage, urea treated rice straw

On-farm feed

- ✓Decrease- rice straw
- ✓Increase- Vura grass, Napier, maize grass, lentil, maskalai

4. Discussion

Economic aspects

- ❑ Decreased-feed costs, Increased- feed production
- ✓ Replaced- Irrigated paddy-Fodder crops, More crops
- ➢ Fodder cultivation increased 15% (Roy et al., 2012)
- ➢ Rice surplus- 2 million ton (Kabir et. al., 2015)
- ➢ Milk shortage- 7 million ton (DLS, 2016)

Environmental aspects

- ❑ Increased-OM balance, Decreased- soil N losses
- ✓ Increased- Maskalai, Vura, Lentil, Maize
- ✓ Green manure, Less chemical fertilizer, Symbiotic N
- ➢ Farmers want to change the crops if profitable (Roy et al., 2012)
- ➢ Green manure increases the OM balance (Chander et al., 1997)
- ➢ Leguminous crops decreased 50-100kg fertilizer(N) ha^{-1} (Fageria, 2007)

5. Conclusions

- ✓ Increased profit (10-209%)
- ✓ Decreased feed costs (4-25%)
- ✓ Increased Self reliance (7-25%)
- ✓ Increased OM balance (4-650%)
- ✓ Decreased Soil N losses (4-21%)

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