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# Productive and reproductive performance of cows reared under organic *vis-à-vis* conventional management system in West Bengal

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ABSTRACT

The study was conducted on 24 Jersey × Tharparkar / Red Sindhi cows maintained at the Institute farm to find the impact of organic dairy farming on milk production, milk composition and reproductive performance of cows and compared with the performance of cows reared under conventional management system. Cows under first year organic production management system (OPMS) had significantly higher yield than the performance of cows under third year OPMS. The differences between first and second year and between second and third year performance was not significant. There was a decrease in milk production in the second year and thereafter reduction rate was very low in the third year. Production and reproduction traits were not affected by the management systems (organic and conventional). The 3-year performance data revealed that the 305-day milk yield was slightly higher for cows maintained under conventional management system than the performance of cows maintained under organic management system (2,488.75 kg vs. 2,392.47 kg). Reproductive performance was better in the organic group than the conventional group. The cows maintained under organic management system had significantly higher fat % (5.25±0.08%) than the cows maintained under conventional management system (4.72±0.11%). Significantly higher protein% was observed for the cows maintained under conventional management system (3.76±0.04%) as compared to the cows maintained under organic management system (3.28±0.03%). The cows under organic management had lower SNF % and higher total solid % than the cows maintained under conventional management. However, the differences were statistically nonsignificant. The results indicated better reproductive performance and higher fat % in organically managed cows than conventional.

**Key words**: Milk composition, Milk production, Organic dairy farming, Reproductive performance

Organic dairy farming is gaining importance in the world to obtain organic milk for better human health. It includes feeding and rearing of animals on organic feed and fodder grown without use of pesticides and chemical fertilizers, the creation of compatible environment for production, health management following organic norms. Indian traditional animal husbandry system has potential for conversion to organic animal husbandry system considering the large livestock population which are well adapted to local situations and mixed – crop livestock farming (Chander and Mukherjee 2005).

In general, the conversions of organic milk production system possess a more or less relevant decrease in milk production, which is at least partially recovered when the new system is well established (Vaarst *et al*. 2003). The percentage of organic milk production shows an increasing trend on global basis. With the growing awareness among the educated and economically sound class of people in India, there is a good scope for production and marketing of organic milk in urban areas. Keeping this in view, the present study was undertaken to find out the impact of organic dairy farming on milk parameters and reproductive performance of cows.

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## MATERIALS AND METHODS

The study was conducted on 24 medium to high yielding Jersey × Tharparkar / Red Sindhi crossbred cows of first to third parity, calving normally, spread over a period of 4 years (2008 – 2011) and maintained at NDRI, Kalyani farm. Out of 24 cows, 12 cows were selected randomly and maintained under organic management system. The rest 12 cows were kept under conventional management system. Information regarding production and reproduction parameters was collected from both groups of cows.

The cows were maintained in the loose housing system under group feeding. For each cow, milk yield, lactation length, date of calving, date of first AI, date of conception, number of AI/conception and date of dry were recorded for generating the data like 305 day milk yield, total milk yield, lactation length, milk yield per day of lactation length, calving interval, milk yield per day of calving interval, days from calving to first service and service period.

Milk samples (both morning and evening) from all the cows were collected at monthly interval for estimation of fat, SNF, protein and total solid in milk as per standard procedure in practice.

To study the influence of farming system on milk production, reproduction and milk quality traits, the analysis of variance with one way fixed effect model was carried out as per Snedecor and Cochran (1968).

## RESULTS AND DISCUSSION

*Performance of cows maintained under organic production management system:* The means along with standard errors for 305-day milk yield, total milk yield, lactation length, milk yield per day of lactation length, calving interval and milk yield per day of calving interval of cows maintained under organic production management system (OPMS) are given in Table 1. There was significant difference (P<0.05) between the year of conversion with respect to 305 days milk yield and total milk yield. The 305-day milk yield in the first, second and third year under OPMS were 2,569.46±176.22 kg, 2,317.18±185.63 kg and 2,288.74±168.26 kg, respectively. Cows under first year OPMS had significantly higher yield than that of cows under third year OPMS. The differences between first and second year and between second and third year performance was not significant. The performance of cows under organic management system has been reduced considerably in the second year as compared to the first year and thereafter reduction rate was very low in the third year. Similarly, Morriset and Gilbert (2000) observed that the conversion to organic dairying was accompanied by a temporary decline in output. Vaarst *et al*. (2003) reported small decrease in milk production in the first year after conversion and returning to the original production in second year. In general, the conversion to organic milk production system may lead to more or less decrease in milk production, which is at least partially recovered when the new system is well established.

No other lactation traits were significantly affected by the year of conversion. The milk yield per day of lactation length in the third year was slightly higher than second year performance and the milk yield per day of calving interval was almost same for both second and third year.

The overall means for 305-day milk yield, total milk yield, lactation length, milk yield per day of lactation length, calving interval and milk yield per day of calving interval were 2392.47±124.87 kg, 2667.91±194.36 kg, 358.64±25.43 days, 7.46±0.32 kg, 425.45±21.48 days and 6.26±0.54 kg, respectively.

*Performance of cows: organic vis-a-vis conventional management system:* The means and standard errors for 305 days milk yield, interval from calving to first service, service period, no. of AI per conception and calving interval of cows maintained under organic as well as conventional management system are presented in Table 2. All the production and reproduction traits were not affected by the management systems (organic and conventional). The 3-year performance data revealed that the 305 days milk yield was slightly higher for cows maintained under conventional

Table 1. Means and standard errors for lactation traits of cows maintained under organic production management system

| Traits→ Effects↓ | No. of observations | 305 days milk yield(kg) | Total milk yield(kg) | Lactation length(days) | Milk yld per day of lactation length(kg) | Calving interval (days) | Milk yld per day of calving interval (kg) |
|---|---|---|---|---|---|---|---|
| Overall mean | 36 | 2392.47±124.87 | 2667.91±194.36 | 358.64±25.43 | 7.46±0.32 | 425.45±21.48 | 6.26±0.54 |
| First year performance | 12 | 2569.46±176.22[a] | 2872.85±238.07 [a] | 371.00±32.91 [a] | 7.72±0.44 [a] | 434.15±18.27 [a] | 6.59±0.37 [a] |
| Second year performance | 12 | 2317.18±185.63[ab] | 2611.81±336.59[ab] | 358.25±21.86 [a] | 7.28±0.52 [a] | 426.56±26.21 [a] | 6.12±0.35 [a] |
| Third year performance | 12 | 2288.74±168.26[b] | 2509.29±246.54[b] | 341.47±18.25 [a] | 7.37±0.35 [a] | 412.24±16.84 [a] | 6.10±0.56 [a] |

a-b means with similar superscripts did not differ significantly (P<0.05) from each other.

Table 2. Means and standard errors for lactation and reproduction traits of cows maintained under organic and conventional production management systems

| Traits→ Effects↓ | No. of observations | 305 days milk yield(kg) | Days from calving to first AI | Service period (days) | No. of AI per conception | Calving interval (days) |
|---|---|---|---|---|---|---|
| Overall mean | 72 | 2442.16±114.57 | 108.98±11.27 | 157.36±16.15 | 1.57±0.14 | 440.94±16.18 |
| Organic production management system | 36 | 2392.47±124.87[a] | 104.46±12.42 [a] | 142.69±18.20 [a] | 1.38±0.15 [a] | 425.45±21.48 [a] |
| Conventional production management system | 36 | 2488.75±132.68 [a] | 115.24±14.17 [a] | 171.35±21.42 [a] | 1.78±0.17 [a] | 458.34±23.34 [a] |

Means with similar superscripts did not differ significantly (P<0.05) from each other.

Table 3. Means and standard errors for milk composition of cows maintained under organic and conventional production management systems

| Traits→ Effects↓ | No. of observations | Fat(%) | SNF(%) | Protein(%) | Total solids(%) |
|---|---|---|---|---|---|
| Overall mean | 360 | 4.98±0.07 | 8.77±0.03 | 3.52±0.03 | 13.89±0.12 |
| Organic production management system | 180 | 5.25±0.08[a] | 8.66±0.04 [a] | 3.28±0.03 [a] | 14.03±0.17 [a] |
| Conventional production management system | 180 | 4.72±0.11[b] | 8.86±0.05 [a] | 3.76±0.04[b] | 13.72±0.16 [a] |

a-b means with similar superscripts did not differ significantly (P<0.05) from each other.

management system than the performance of cows maintained under organic management system (2,488.75 kg vs. 2,392.47 kg). Similarly, Sato *et al*. (2005) observed that organic farms had about 15% lower milk production per cow (20.2 kg/day) compared to conventional farms (23.7 kg/day). Nauta *et al.* (2006) reported lower milk production on long standing organic farms than on conventional and converted organic farms. Vaarst *et al*. (2003) reported that the average daily milk production in organic and in conventional dairy farming remained more or less the same. Mahlkow (2004) found similar volume of milk production for organic Holstein cows as well as conventional. The decline in milk production can be explained by the reduced input of concentrates and a lower roughage quality in terms of energy and protein content. Organic roughage is produced without chemical fertilizer and consequently has lower energy and protein compounds (Padel 2000).

Interval from calving to first AI, service period, No. of AI per conception and calving interval were found less for organic cows than conventional cows. This showed comparatively better reproductive performance of cows maintained under organic management system than cows maintained under conventional management system. Similarly, Hovi *et al*. (2003) concluded that conversion to organic did not affect the fertility status of the animals at organic farms. CI was also not significantly affected by conversion (Nauta *et al.* 2006). Organic management causes less metabolic stress for the more natural management but for the same reason, the milk yield is always smaller and the reproductive performance is often better.

*Milk composition of cows: Organic vis-a-vis conventional management system:* The means along with standard errors of various milk composition traits of Jersey crossbred cows maintained under both organic and conventional management system are presented in Table 3. The overall means for fat%, SNF%, protein% and total solid% were 4.98±0.07%, 8.77±0.05%, 3.52±0.03 and 13.89±0.12%, respectively. There was significant difference (P<0.05) between the two management systems with respect to fat% and protein%. The cows under organic management had lower SNF% and higher total solid% than the cows maintained under conventional management. However, the differences were statistically nonsignificant. The cows maintained under organic management system had significantly higher fat% (5.25±0.08%) than the cows maintained under conventional management system (4.72±0.11%). On the other hand, significantly higher protein% was observed for the cows maintained under conventional management system (3.76±0.04%) as compared to the cows maintained under organic management system (3.28±0.03%). Padel (2000) reported that there was an overall increase of percentage fat which is probably because of more roughage in the diet at organic farms. He also reported that the fat percentage decreased in the first 2 years after conversion to organic management. This is probably due to decrease in energy in the roughage and a lower amount of concentrate feeding in the first years of conversion. On the contrary, Mahlkow (2004) reported lower Fat% for organic Holstein cows (4.09%) than conventional cows (4.26%).

Low milk protein content for organic cows might be due to low protein content in fodder grown on organic farms and less amount of concentrate feeding which is not as sufficient as oil seed extracts used in conventional production. Similar finding was observed by Mahlkow (2004), who reported that lower protein content (3.26%) for organic cows than conventional (3.39%). Olivo *et al*. (2005) reported lower milk protein content in the agro-ecological system than conventional system.

The results tend to conclude that reproductive performance and milk quality (milk fat) was better and 305-day milk yield was lower for cows maintained under OPMS than conventional systems.

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