Opportunities for Change in Small Ruminant Systems in Central Java-Indonesia

IGS Budisatria[1)*], HMJ Udo[2)], TC Viets[2)] and AJ van der Zijpp[2)]

[1)]Faculty of Animal Science, GadjahMada University, Jl. Fauna 3, Kampus UGM Bulaksumur, Yogyakarta 55281, Indonesia
[2)]Animal Production Systems Group, WIAS-Wageningen University, Wageningen, The Netherlands
***Corresponding author e-mail: budisatria1968@yahoo.com**

Abstract. This study evaluated sheep fattening and goat breeding innovation scenarios for small ruminant systems in Central Java. In sheep fattening scenario 1, farmers were proposed to fatten 5 male sheep two times a year, in sheep fattening scenario 2, farmers were proposed to fatten sheep in one round of 9 months up to the age of one year. In sheep fattening scenario 3, farmers were proposed to fatten male sheep in two periods, one round with 5 animals as in scenario 1, and another round with 5 animals sold at one year of age for *Idul Adha.* Goat breeding scenarios were based on a breeding unit with 3 does and involved reductions of kidding intervals from 278 (middle zone) and 273 (uplands) days to 240 and 220 days. The sheep fattening scenarios indicated that if farmers could start specialising in sheep fattening, the technical and economic results could be improved compared to the present sheep production system. Sheep fattening scenario 3 showed the highest net live-weight production in kg and the highest value added. When the opportunity labour costs were included in the calculations, fattening of sheep still produced a positive net return to the farmers. A goat breeding unit with 3 does produced 2.2 and 1.7 times more kids than in the real situation in the middle zone and uplands, respectively. Reducing kidding intervals resulted in an increase of kids sold by 1.2 and 1.3 respectively for kidding intervals 240 and 220 days in the middle zone; while in the uplands this was 1.1 and 1.3 times respectively. The breeding scenario calculations indicated that goat breeding could make a positive contribution to the livelihood of goat farmers, if the management of goats was improved.

Keywords: sheep fattening, goats breeding, value added, Indonesia

---

Abstrak. Penelitian ini mengevaluasi sistem pengembangan ternak ruminansia kecil di Jawa Tengah-Indonesia melalui program simulasi penggemukan domba dan pembibitan kambing. Simulasi 1 adalah simulasi penggemukan domba dua periode per tahun dengan jumlah domba masing-masing 5 ekor. Simulasi 2 adalah simulasi penggemukan domba dalam jangka waktu 9 bulan sampai domba berumur 1 tahun. Simulasi 3 adalah simulasi penggemukan domba selama dua periode per tahun, satu periode seperti pada simulasi 1, sedangkan satu periode penggemukan ditujukan untuk dijual menjelang Idul Adha. Pada simulasi pembibitan kambing, dilakukan simulasi dengan memelihara 3 ekor induk kambing dengan melakukan inovasi pemendekan jarak beranak dari 278 (pada zona sedang) dan 273 (pada zona tinggi) menjadi 240 dan 220 hari. Hasil simulasi menunjukkan bahwa secara teknis penggemukan domba dapat dilakukan dan secara ekonomis dapat memberikan keuntungan yang memadai dibandingkan dengan sistem penggemukan yang saat ini diterapkan oleh peternak. Penggemukan domba pada simulasi 3 memberikan hasil yang terbaik ditinjau dari produksi bobot hidup dan nilai tambah. Apabila biaya tenaga kerja dimasukkan dalam simulasi, penggemukan domba masih memberikan keuntungan bersih kepada peternak. Hasil simulasi pembibitan 3 ekor induk kambing menghasilkan 2,2 dan 1,7 kali lebih banyak cempe, masing-masing pada zona sedang dan zona tinggi, dibandingkan dengan kondisi saat ini yang dialami oleh peternak. Pemendekan angka jarak beranak juga akan mengakibatkan meningkatnya jumlah cempe yang dijual. Pada zona sedang, peningkatannya masing-masing sebesar 1,2 dan 1,3 kali apabila jarak beranak diturunkan menjadi 240 dan 220 hari, sedangkan pada zona tinggi, peningkatan jumlah anak yang dijual sebesar 1,1 dan 1,3 kali. Hasil simulasi mengindikasikan bahwa pembibitan kambing memberikan kontribusi yang positif sebagai sumber penghidupan peternak kambing apabila manajemen pemeliharaan ditingkatkan.

Kata kunci: penggemukan domba, pembibitan kambing, nilai tambah, Indonesia

---

Introduction

It is often said that small ruminants could make a contribution to better livelihoods of the rural poor in developing countries (Devendra and Chantalakhana, 2002; Kristjanson et al., 2002; Dossa et al., 2003; Iniguez, 2004; Lebbie, 2004; Holmann et al., 2005; Peacock, 2005; Saadullah et al., 2005) with a high return on the investment (De Vries, 2008). In South East Asia, Indonesia is one of the countries with increasing numbers of small ruminants, which according to policy makers, NGO's and other institutions, could improve the ability of households to stabilize their income and help increase animal protein consumption. Recent studies on small ruminant production systems in Central Java indicated that it was unlikely for small ruminants to be the main income earner in rural households. If households had sufficient family labour for the management of small ruminants, small ruminants were an appreciated secondary activity. While small ruminants were multifunctional, the economic benefits of keeping small ruminants however were low (Budisatria et al., 2010).

Innovations in small ruminant systems had to match the specific agro-ecological conditions. In Central Java, in lowland areas small ruminants were integrated with paddy and cassava production. In the higher altitude areas (middle zone and uplands) small ruminants could make use of the abundant leaves available. In the lowlands, there were not many leaves available and many farmers thought that goats could not be managed properly under this condition. Here, sheep had slightly better performances than goats (Budisatria et al., 2010). The lowlands had a more favourable infrastructure than the middle zone and uplands. The uplands had the poorest infrastructure and 40 per cent of the families lived below the poverty line. Farmers in the lowlands had easy access to markets. The demand and prices of small ruminants increased considerably before the feast of sacrifice, *Idul Adha*. In the lowlands, the market situation was relatively stable throughout the remainder of the year, whereas, in the middle zone and uplands prices dropped at the end of dry season when urgent cash was needed for e.g. land preparation and payment of school fees (Budisatria et al., 2008).

It was found that performances of sheep could be improved with relatively low levels of supplementation of rice bran (Merkel et al., 1999). In the lowlands farmers had easy access to rice bran. Therefore, sheep fattening on basis of rice bran supplementation could be a feasible innovation in the lowlands, particularly when farmers could arrange the sale of fattened males in relation to the period of the feast of sacrifice.

The higher altitude areas had become well known breeding areas for Etawah-grade goats and farmers could receive relatively high prices for breeding stock (Budisatria et al., 2008). Goat breeding with the aim to supply the market with kids for breeding could offer an opportunity to increase the contribution of goats to rural livelihoods. Although the number of annual kids weaned per doe was around 2.5, kidding intervals were relatively long: on average over 270 d. Consequently, reducing kidding intervals could offer scope to increase the number of kids available for sale in the middle zone and uplands.

Kosgey (2006) concluded that small ruminant improvement programmes predicted to be successful were those that were simple, pragmatic, and inexpensive. This study evaluates sheep fattening and goat breeding innovation scenarios for small ruminant systems in different agro-ecological zones in Central Java, Indonesia.

Materials and Methods

Study area. This study was based on sheep and goat production in three agro-ecological zones

in the Province of Yogyakarta, Indonesia. The lowlands (100 m above sea level (asl)), were characterised by irrigated paddy fields mixed with cassava. The main feed resources for small ruminants were native grass and crop residues (Budisatria et al., 2010). The middle zone (between 100 and 500 m asl) was characterized by multiple cropping systems, with a combination of paddy fields and annual crops. In the uplands (above 500 m asl) the main crops were cassava, maize, groundnut and vegetables. In both the middle zone and uplands the main feed resources used were native grass and leaves of legume trees, fruit trees, cassava and hibiscus (Budisatria et al., 2010). In total, 150 small ruminant (Etawah-grade goats or Javanese fat-tailed sheep) farmers were randomly selected for small ruminant performance recording and interviewed on their opinion about small ruminant farming: 50 farmers in lowlands, middle zone and uplands each. Table 1 showed selected characteristics of the sheep farming systems in the lowlands and goat farming systems in the middle zone and uplands.

Scenario studies. In the lowlands, sheep fattening was proposed by some farmers as a feasible innovation. Here, average daily gain could be improved from the present 0.06 to 0.15 kg d^{-1} per head by increasing the level of rice bran supplementation from the present level of 0.13 to 0.3 kg d^{-1}. Farmers mentioned during interviews that the maximum number of sheep they could keep at a time was 5. In sheep fattening scenario 1, farmers were proposed to fatten 5 male sheep two times a year, with an initial bodyweight 10 kg and average daily gain around 0.15 kg. The sheep could be sold at 9 months of age with a final bodyweight of around 35 kg. In scenario 2, the sheep were 9 months to one year old, with initial body weight of 10 kg and average daily gain of 0.1 kg for one round. It was expected that in this scenario farmers could arrange their sheep fattening in relation to *Idul Adha*. In scenario 3, farmers were to fatten male sheep in two periods, one round with 5 animals from 3-9 months of age as in scenario 1, and another round with 5 animals bought at 6 months of age at an initial bodyweight 18 kg and average daily gain of 0.1 kg up to one year of age. Mortality during the fattening period was assumed to be 10% (Budisatria et al., 2010).

The input values used for the sheep fattening scenarios were shown in Table 2. Three selling price levels were suggested: sheep fattening scenario 1 with an average price received by farmers over the normal and risky (end of dry season) market situations; sheep fattening scenario 2 with a level where animals were sold for prices received by farmers during the last few weeks before *Idul Adha*; sheep fattening scenario 3 with a level where animals from one fattening around are sold for the price during religious festivities and the others are sold for the price received by farmers during the normal and risky market situation. Farmers did not use veterinary services. The labour accounted in the scenario study was only adult labour, whereas the family labour was hired under the present production systems including children (Budisatria et al., 2010).

The aim of the breeding scenarios was to increase the number of sold kids, with a constant flock size of three female goats. The kids would be weaned when they reached three months old and would be sold directly after weaning. Kidding intervals were on average 278 and 273 days respectively (Table 1). This kidding interval was used as one of the goat breeding scenarios in calculations of the effect of reducing kidding intervals. The calculations also included a kidding interval of 220 days. This would require less mating per conception than the present level of 1.7-1.8 (Budisatria et al., 2010).

Simulation model calculations. A simulation model (Figure 1) was developed with Stella®

software to simulate the performance of a goat breeding farm and the effect of reducing kidding intervals. Table 3 gave the initial parameters used in this model, based on actual figures resulting from monitoring sheep and goat performances in Central Java (Budisatria et al., 2010).

First, the present kidding intervals (278 and 273 days for the middle zone and uplands respectively) were simulated on basis of a flock size of adult females of 3. Second, the effects of kidding intervals of 240 and 220 days were simulated. The development of the flock size was calculated based on the equation: goats (t) = goats (t-dt) + births – deaths- sales-culled goats) x dt. This equation means that the number of goats at a certain time t is equal to the number of goats at time t-dt plus the number of births minus deaths minus kid sales minuscule goats.

The number of kids born was influenced by the kidding intervals and litter size, therefore, the births inflow, which equals the number of culled goats, was calculated by using the equation: births = goats x litter size x (365/kidding intervals). The mortality parameter, the mortality from birth to weaning (90 days), in this study was set to 5%. In equation form, the mortality was deaths = births x mortality rates. The culled goat parameter, the number of goats being replaced was: Culled goats = Goats x replacements. The numbers of kids sold was determined by the mortality rate and the numbers of kids to be used as breeding stock, which equalled to the number of culled goats: Kid sales = births-culled goats-deaths. Feed costs were based on the concentrate (rice bran) fed: Feed cost = concentrates x (does + 1) x feed price x 365. The feed costs only take rice bran supplementation into account. The collection of roughages (field grass and leaves) was included in the family labour spent. The opportunity family labour costs were based on the time (hours) that farmers spent per day: Labour cost = labour wage x labour work x (goats + 1) x 365. Extra labour cost for kids = labour wage x labour work x kids birth x 90. The number of goats was based on the number of does increased with 1 male goat.

The added value consisted of income from selling kids (benefit 1), manure (benefit 2), and culled goats (benefit 3): Benefit 1 = kid price x kid sales. Benefit 2 = manure production x manure price x (goats + 1) x 365. Benefit 3 = culled goats x culled price.

Table 1. Characteristics of sheep farming systems in the lowlands and goat farming systems in the middle zone and uplands, in Central Java, Indonesia

	Lowlands		Middle zone		Uplands	
	Sheep	Goats	Sheep	Goats	Sheep	Goats
Flock size	3.5	3.2	3.9	3.9	3.7	4.2
Flock composition						
Adult female	1.6	1.5	2.1	1.9	2.2	2.5
Adult male	0.7	0.6	0.5	0.7	0.5	0.6
Lamb/Kid	1.2	1.1	1.3	1.3	1.0	1.1
Lambing/Kidding interval(*d*)	279	282	264	278	271	273
Lambs/Kids weaned per ewe/doe y^{-1}	1.8	1.8	2.0	2.4	1.8	2.7
Time spent *($h.d^{-1}$)*	3.6	3.4	3.7	3.7	4.2	4.2
Value Added**($Rp10^3$ y^{-1})*	1328	1249	1227	1293	1364	1718
VA – opportunity labour costs *($Rp10^3$ y^{-1})*	-643	-613	-777	-733	-930	-572
Additional benefits** *($Rp10^3$ y^{-1})*	192	191	229	229	212	265

* value added based on live-weight production and manure, ** based on financing and insurance value estimations (Budisatria et al., 2010).

Table 2. Inputs values for proposed three sheep fattening scenarios in the lowlands in Central Java, Indonesia

Parameters	Scenarios*		
	1	2	3
Start weight (*kg*)	10	10	10 and 18
End weight (*kg*)	37	37	36
Rice bran (*kg d^{-1}head*)	0.3	0.2	0.3 and 0.2
Feedlot period (*dhead*)	180	270	180
Mortality (%)	10	10	10
DM manure production (*kg d^{-1}head*)	0.5	0.5	0.5
Price weaner sheep (*Rp10^3*)	250	250	250 and 300
Selling price (*Rp kg^{-1}*)	13500	19000	13500 and 19000
Rice bran price (*Rp kg^{-1}*)	600	600	600
Manure price (*Rp kg^{-1}*)	150	150	150
Time spent (*h d^{-1}*)	3.2	3.2	3.2
Opportunity family labour costs(*Rp h^{-1}*)	1500	1500	1500

*Scenario 1: two fattening rounds of animals from 3-9 months of age; Scenario 2: one fattening round of animals from 3-12 months of age; Scenario 3: one fattening round of animals 3-9 months and one round of animals from 6-12 months of age

Table 3. Model input values used in the simulations of the effects of actual and reduced kidding intervals for goat flocks in Central Java, Indonesia

Parameters	Model values
Reproduction parameters:	
- Number of does	3
- Kidding intervals (*d*)	278; 273; 220 and 240
- Litter size	2
- Mortality up to weaning (*%*)	5
- Replacements (*%*)	25%
Input parameters:	
- Rice bran (*kg d^{-1} per head*)	0.15 and 0.3
- Rice bran price (*Rp kg^{-1}*)	650
- Time spent (*h d^{-1} per adult head*)	0.5
- Extra labour used for kids (*h d^{-1} per kid*)	0.25
- Manure production (*kg d^{-1} per head*)	0.5
- Kid selling price (*Rp 10^3 per head*)	400
- Culled goats selling price (*Rp 10^3 per head*)	500
- Manure price (*Rp kg^{-1}*)	150
- Opportunity costs labour (*Rp h^{-1}*)	1500

Results and Discussion

Sheep fattening. Table 4 gives the results of the sheep fattening scenarios for the lowlands. Inputs included the purchase of weaned sheep and rice bran. Farmers also fed cassava peels and field grass. The collection of these feeds was included in the family labour hours spent. Benefits of keeping sheep were cash income from selling sheep for slaughter and for *Idul Adha* and manure. Sheep fattening scenario 1 with two fattening rounds for the average marketing conditions and scenario 3 with one fattening round for the average marketing conditions and one for the *Idul Adha* period showed the highest net live-weight production in kg. The value added of sheep fattening scenario 1 was about the same as the value added of sheep fattening scenario 2 with one fattening round producing 1-year old males for the *Idul Adha* period. Sheep fattening scenario 3 gave the highest value added. When the opportunity labour costs were included in the calculations, fattening of sheep still produced

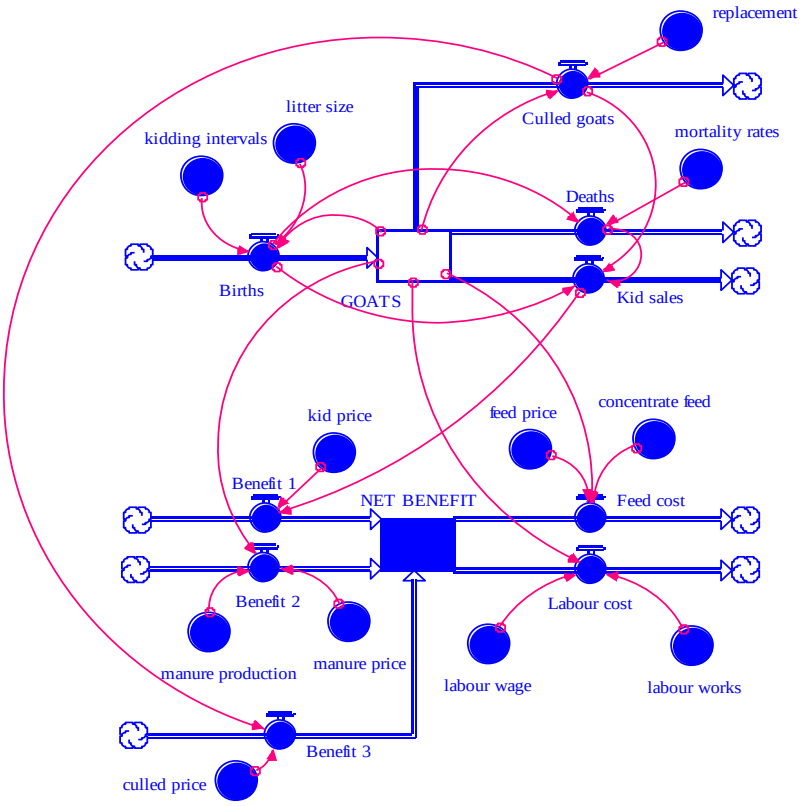

Figure 1. A simulation model the performance of a goat breeding farm and the effect of reducing kidding intervals.

a positive net return to the farmers, but this time the highest returns were produced by scenario 2, because less labour was required in this scenario.

The sheep fattening scenarios indicated that if farmers could start specialising in sheep fattening the technical results could be improved compared to the present sheep production system in which breeding of sheep and sale for meat were both practised. Sheep fattening resulted in 32-55% higher value added benefits, on basis of live-weight production and manure, than from the present production system (Budisatria et al, 2010). The scenarios (Table 4) did not take the intangible benefits into account; it was expected that fattened sheep were purely kept for the market. The calculations indicated that fattening of sheep in two rounds in the lowlands could give sufficient returns to the hours of family labour spent; however on a daily basis the returns remained low. The returns were the highest when farmers could fatten sheep in two rounds with one round for the *Idul Adha* market (Scenario 3). Reynolds and Adediran (1994) already concluded that when the demand for small ruminant meat was high and prices were attractive, short-term fattening, rather than breeding would appear more commercially attractive. By using a relatively high supplementation level of rice bran compared to the real situation had as consequence that feed costs were 2 and 2.6 times higher than in the actual situation. Bhatta et al. (2007) found that in one side, high level of supplementation tended to increase production cost, on the other side, it also produced the best in terms of efficiency ratio. Therefore, the sheep fattening scenarios required access to capital to purchase weaners and rice bran. In the lowlands, this did not have to be a major problem since farmers had easy access to formal credit from government or private institutions with relatively low interest rates.

In the real situation, 16% of sheep farmers already fattened sheep. This was about the

percentage of sheep farmers that could start fattening males on basis of the present average flock size in the lowlands of 1.9 ewes and the number of annual weaning per ewe was 1.8 (Budisatria et al., 2010). However, because of the relatively good infrastructure in the lowlands farmers could obtain weaning sheep from other areas and a higher percentage of sheep farmers could start fattening sheep.

Sheep fattening scenario 2 and 3 showed that matching fattening sheep to *Idul Adha* demand was theoretically feasible. In the present situation, however, none of the farmers fattened sheep to meet *Idul Adha* demand. They found it too difficult to plan their sale of animals in relation to the period when the prices increased. Farmers also complained that there was no marketing information available to them, the information they receive was via the village collectors (Budisatria et al., 2008). Without accurate market information, farmers were seriously disadvantaged in basic decision making concerning production opportunities and marketing options.

Goat breeding. Table 5 shows the technical and economic results of model simulations for a breeding unit with 3 does on basis of present kidding intervals and reduced kidding intervals in the middle zone and uplands. Reducing kidding intervals resulted in an increase of kids sold by 18% and 30% for the kidding intervals 240 and 220 days respectively in the middle zone; while in the uplands this was 15% and 26% respectively. Family labour was by far the highest input. The value added estimates were 14-17% higher with a kidding interval of 240 d and 25-28% higher with a kidding interval of 220 days when compared with the present kidding intervals.

Monitoring flock performances in the middle zone and uplands showed that the number of kids available for sale were 3 and 4 respectively. The differences in the results between the goat breeding scenarios based on present kidding intervals and the real values from Budisatria et al. (2010) in the middle zone and uplands were the result of the larger number of does in the simulated situation. As a consequence, the produced and sold kids increased significantly. Compared to the scenarios with the real kidding intervals, the kidding interval of 240 days resulted in 14-17% higher number of kids for sale and the interval of 220 days in 25-28% increase in number of kids for sale. This increase was caused by the higher number of kids being sold. Overall, the breeding scenarios resulted in higher returns to the family labour used than the sheep fattening scenarios. On a daily basis the returns were still below a minimum wage level for one person.

Reducing kidding intervals to 240 days could be technically feasible, considering that 16% and 28% of goats kept by farmers in the middle zone and uplands already had kidding intervals of around 240 days. Reducing kidding intervals to 220 days would be difficult to achieve. Farmers had to improve their present management in order to reduce the kidding intervals. Long kidding intervals resulted from does' not being mated because bucks were absent, limited farmers knowledge on basic physiology of reproduction in small ruminants especially oestrus detection and duration. Difficulties on oestrus detection, insignificant oestrus sign, and unknown time of ovulation caused low reproduction performance of the animal (Widayati et al., 2010). Reproductive performance was one of the main determinants of productivity of small ruminants (Tano et al., 2003; Menendez-Buxadera et al., 2004; Mellado et al., 2006). Improving the reproduction capacity could be done by making bucks available to does. Farmers also had to reduce post partum mating intervals by better feed management and reducing weaning age of kids. In the 240 and 220 days kidding interval scenarios, better feed management was simulated by increasing the rice bran supplementation; it was around 2 times higher

than supplementation done by farmers (Budisatria et al., 2010). In the real situation, farmers with goats showing 240 day kidding intervals also used more rice bran supplementation. Although feeding sheep and goats with alternative feed resources could maintain animal productivity, supplementation was needed and carefully formulated in order to guarantee their nutritional requirements (Vasta et al., 2008). Reducing kidding intervals also implied that farmers had to wean kids at three months old. Productivity of the ewe could be improved by increasing the frequency of lambing, furthermore, management systems in which ewes were re-bred 2.5–3.5 months after lambing might offer producer an opportunity to maximize the productivity (Knights et al., 2012).

Table 4. Impact of sheep fattening scenarios on net live-weight and manure production, and economic benefits (in Rp 10^3 y^{-1}) in the lowlands of Central Java, Indonesia

Parameters	Scenarios*		
	1	2	3
Inputs:			
Sheep fattened per year (*h*)	10.0	5.0	10.0
Weaner costs per year (*Rp10^3*)	2500.0	1250.0	3500.0
Feed costs (*Rp10^3 y^{-1}*)	324.0	243.0	324.0
Labour (*h d^{-1}*)	3.2	3.2	3.2
Opportunity costs family labour (*Rp 10^3 y^{-1}*)	1752.0	1296.0	1752.0
Outputs:			
Net live-weight production *(kg)*	333.0	165.5	324.0
Manure *(kg)*	821.5	607.0	821.0
Income from selling sheep	4495.0	3164.0	5265.0
Income from manure	123.0	91.0	123.0
Value Added	1795.0	1762.0	2064.0
VA – opportunity labour costs	43.0	466.0	312.0
VA per d *(Rp)*	4917.0	4826.0	5655.0

*Scenario 1: two fattening rounds of animals from 3-9 months of age; Scenario 2: one fattening round of animals from 3-12 months of age; Scenario 3: one fattening round of animals 3-9 months and one round of animals from 6-12 months of age
1 € = Rp12000.

Table 5. Model simulations of the effects of present and reduced kidding intervals on the number of kids sold and economic values (in Rp 10^3 y^{-1}) of small ruminants in the middle zone and uplands of Central Java, Indonesia

	Present intervals		Reduced Intervals	
	278 days (middle zone)	273 days (uplands)	240 days	220 days
Flock size (*adult head*)	3.0	3.0	3.0	3.0
Births	7.9	8.1	9.1	10.0
Deaths	0.4	0.4	0.5	0.5
Culled goats	0.8	0.8	0.8	0.8
Kid sales	6.7	6.9	7.9	8.7
Feed costs	285	285	285	285
Opportunity costs family labour	1362	1368	1402	1433
Income sales of kids	2694	2760	3168	3483
Income manure	82	82	82	82
Income sales of culled does	375	375	375	375
Value Added	2866	2932	3340	3655
VA – opportunity labour costs	1504	1564	1938	2223
VA per d *(Rp)*	7852	8033	9150	10014

The most important input in the breeding scenarios was family labour. This labour was mainly used to collect roughages. More kids also meant more family labour input for daily care. Farmers with sufficient household labour available would not consider the labour costs as real costs (Qureshi, 1993). Inclusion of family labour cost in the economic analysis significantly could inflate the total cost and could have a negative effect on feasibility (Hamadeh et al., 2001). The demand for labour to support feed management was one of the critical issues facing the sheep systems, due primarily to high labour costs andrelated social problems (Olaizola et al., 2008). Alternative employment opportunities were limited either because they were not available particularly in the uplands, or because household members were not competitive in these job markets.

The breeding scenario calculations indicated that goats could give a positive return to the family labour used and could make a contribution to farmers' incomes, in particular if the management of goats was improved. The middle zone and uplands were known for the quality of their small ruminants, primarily Etawah-grade goats (Budisatria et al., 2010). Therefore, marketing of kids for breeding did not seem to be a constraint. Farmers sold Etawah-grade breeding stock even to farmers outside Central Java. The initial investment needed to buy breeding stock of Etawah-grade goats was quite high and it could be too high for the poor families (Budisatria et al., 2010). The availability of micro credit systems was necessary. Galanopoulus et al. (2011) concluded that without an effective financial support scheme, farmers would not be able to survive in an increasingly competitive market environment and their number would continue to decline. Also small ruminant farmers needed access to reliable and affordable support services (Udo and Budisatria, 2011).

The scenario studies were made as simple as possible in order to be easily adopted by farmers. Kosgey et al. (2006) concluded that small ruminant improvement programmes that were seen to be successful were those that were simple, pragmatic, and low cost.

Conclusion

It could be concluded that when households had sufficient family labour for the management of small ruminants, it was possible to have income-increasing activities with sheep or goats.

References

Bhatta R, S Vaithiyanathan, NP Singh and DL Verma. 2007. Effect of feeding complete diets containing graded levels of *Prosopis cineraria* leaves on feed intake, nutrient utilization and rumen fermentation in lambs and kids. Small Rum. Res. 67(1):75-83.

Budisatria IGS, HMJ Udo, AJ van der Zijpp, E Baliarti and TW Murti. 2008. Religious festivities and marketing of small ruminants in Central Java. Asian J. Agric. Dev. 5(2):57-74.

Budisatria IGS, HMJ Udo, CHAM Eilers, E Baliarti and AJ van der Zijpp. 2010. Preferences for sheep or goats in Indonesia. Small Rum. Res. 88:16-22.

De Vries J. 2008. Goats for the poor: Some keys to successful promotion of goat production among the poor. Small Rum. Res. 77:221-224.

Dossa H, R Birner and C Wollny. 2003. Small ruminants and livelihood of poor rural people in Southern Benin. Abstract. DeutscherTropentag, October 8-10, 2003, Göttingen.

Devendra C and C Chantalakhana. 2002. Animal, poor people and food insecurity: Opportunities for improved livelihoods through efficient natural resources management. Outlook on Agriculture. 31:161-175.

Galanopoulus K, Z Abas, V Laga and I Hatziminaoglou. 2011. The technical efficiency of transhumance sheep and goat farms and the effect of EU subsidies: Do small farms benefit more than large farms? Small Rum.Res. 100:1-7.

Hamadeh SK, GN Bistanji, MR Darwish, MA Said and DAG Hanem. 2001. Economic sustainability of small ruminants' production in semi-arid areas of Lebanon. Small Rum. Res. 40:41-49.

Holmann F, L Rivas, N Urbina, B Rivera, LA Giraldo, S Guzman, M Martinez, A Medina and G Ramirez. 2005. The role of livestock in poverty alleviation: An analysis of Colombia. Livestock Res. Rural Dev. 17.

Iniguez L. 2004. Goats in resource-poor systems in the dry environments of West Asia, Central Asia and the Inter-Andean valleys. Small Rum. Res. 51:137-144.

Knights M, N Siewa, R Ramgattie, D Singh-Knights and G Bourne. 2012. Effect of time of weaning on the reproductive performance of Barbados Blackbelly ewes and lamb growth in the tropics. Small Rum. Res. 103:205-2010.

Kosgey IS, RL Baker, HMJ Udo and JAM van Arendonk. 2006. Successes and failures of small ruminant breeding programmes in the tropics: A review. Small Rum. Res. 61:13-28.

Kristjanson P, F Place, S Franzel and PK Thornton.2002. Assessing research impact on poverty: The importance of farmers' perspectives. Agric. Systems. 72:73-9.

Lebbie SHB. 2004. Goats under household conditions. Small Rum. Res. 51:131-136.

Mellado M, R Valdez, JE Garcia, R Lopez and A Rodriguez. 2006. Factors affecting the reproductive performance of goats under intensive conditions in a hot arid environment. Small Rum. Res. 63:110-118.

Menendez-Buxadera A, G Alexandre and N Mandonnet. 2004. Discussion on the importance, definition and genetic components of the number of animals born in the litter with particular emphasis on small ruminants in tropical conditions. Small Rum. Res. 54:1-11.

Merkel RC, K Simanihuruk, SP Ginting, J Sianipar, LP Batubara and KR Pond. 1999. Growth potential of five sheep genotypes in Indonesia. Small Ruminant Res. 34:11-14.

Olaizola AM, T Chertouh and E Manrique. 2008. Adoption of a new feeding technology in Mediterranean sheep farming systems: Implications and economic evaluation. Small Rum. Res. 79:137–145.

Peacock C. 2005. Goats - a pathway out of poverty. Small Rum. Res. 60:179-186.

Qureshi AW. 1993. Issues related to sustainable development of livestock production. In: Strategies for Sustainable Animal Agriculture in Developing Countries. FAO Animal Production and Health paper no. 107, FAO, Italy. Pp 1-5.

Reynolds L and G Adediran. 1994. Composition of village goat herds in Southwest Nigeria. Small Rum. Res. 13:49-53.

Saadullah M, MM Hossain and S Akhter. 2005. Experiences with goat project as a tool in human development: goats for poor women in Bangladesh. Proceedings of a Workshop. Women in Agriculture and Modern Communication Technology. http://www.husdyr.kvl.dk/htm/php (September 16, 2008).

Tano K, M Kamuanga, MD Faminow and B Swallow. 2003. Using conjoint analysis to estimate farmer's preferences for cattle traits in West Africa. Ecological Economics. 45(3):393-407.

Udo HMJ and IGS Budisatria, 2011. Fat-tailed sheep in Indonesia; an essential resource for smallholders. Tropical Anim. Health and Prod. 43:1411–1418.

Vasta V, A Nudda, A Cannas, M Lanza and A Priolo. 2008. Alternative feed resources and their effects on the quality of meat and milk from small ruminants. Anim. Feed Sci. and Technol. 147:223-246.

Widayati DT, A Junaidi, K Suharto, A Oktaviani and Wahyuningsih. 2010. Reproduction performance of Etawah Cross bred goats in estrus synchronization by controlled internal drug release implant and PGF2α continued by artificial insemination. World Academy of Science, Engineering and Technology. 65:1077-1079.