The development potential of goat for poverty reduction in Windusari Subdistrict, Magelang Regency

S Utomo* and N Rasminati

Department of Animal Husbandry University of Mercu Buana Yogyakarta PGRI
Madiun, Jl. Setiabudi No.85 Madiun, Indonesia

*Email: setyo@mercubuana-yogya.ac.id

Abstract. This research was conducted in two villages with poor category, Wonoroto and Ngemplak villages, Windusari subdistrict of Magelang regency, aiming to know the potential of local resources for the development of goats, in order to eradicate poverty. Primary data were taken by census of 35 goat farmers in the two villages, while competitor's livestock data were sampled on 50 sheep breeder. Cattle competitors' data were calculated based on monograph data of two research villages. The data analysis was done descriptively on the production of forage (in dry matter), goats population on adult, young and kid phase. Based on the results of the research, it was known that every household of goat farmers had production of feed sources (dry matter) for ruminant livestock as much as 1954.87 kg. Thus, the capacities of livestock per household were 0.85 animal unit equivalent to 6 adult goats or 1 head of heifers. It was found that the average land that produced fodder for two villages was 350.77 ha. The production of forage (DM) in Ngemplak and Wonoroto villages in one year averaged 363.05 ton/year or total of two villages was 726.10 ton/year, then the two areas had the capacity of livestock as much as 315.69 AU or about 157.85 AU for each village. The performance of goat reproductive in two areas, the average sex ratio was 1: 6.5, with the first kidding of 18 months, the kidding interval of 8.9 months and littersize 1.3. It is concluded that each goat-raiser family is still possible to increase its ownership, the area of two poor villages is still able to accommodate goats as much as 8,275 AU, with reproduction status which still needs to improve again.

1. Introduction

Goat raising gives a significant contribution to farmers’ income, which is 15-48% of total income, depends on the cropping pattern of farming. [1] Goat raising has an important role in overcoming the farmers' economic crisis due to the failure of their farms during the long dry season. Goat raising also acts as saving; it is appropriate to be developed more intensively to overcome the problems of rural poverty [2].

Goats are mountain animals which like to live on slopes, like to find food in a dispersed manner and easily adapt to various environmental conditions [1]. Goat populations in Indonesia in 2011 reached 17,482,723, of which 56.42% or 9,864,157 were found in Java, 23.59% in Sumatra, and the rest on other islands [3]. Productivity is highly dependent on efficient feeding and nutrition in terms of achieving productivity limits (meat, milk and skin) [4]. The purpose of the study was to determine the capacity of the regions in two poor villages for the development of goats raising, the adequacy of feed and reproduction of goats.
2. Method
The study was conducted in April - October 2017 in two poor villages namely Ngemplak and Wonoroto, Windusari subdistrict, Magelang regency. The materials studied were breeders, forage feed, agricultural waste, various phases of male and female goat raising, monographic data on the condition of annual crops, agricultural crops, and agricultural waste production as well as the population of cow and sheep as competitors. The equipments were used for measuring instruments in the form of scales, stationery, and questionnaire.
This study used a census method in which data collection was carried out on all goat farmers in two villages. The data included the population of goat species in various phases, ownership of agricultural land, forage feed area, production of forage cultivation samples, natural grass, and agricultural waste which were measured directly in the land and reproductive performance, then analyzed descriptively [5].

3. Result and Discussion
Based on the results of the study, it is found that the full identity of the respondent is listed in Table 1.

Table 1. The identities of respondents of goat farmers in Windusari subdistrict, Magelang regency, Indonesia.

| Research sites | Age (y.o) | Education Level (%) | Breeding experience (year) |
|----------------|----------|---------------------|---------------------------|
|                |          | Elementary School   | Middle School  | High School  | College |                  |
| Ngemplak Village | 43.08     | 83.25               | 20.55         | 1.34         | 0       | 19.83             |
| Wonoroto Village | 44.40     | 82.60               | 15.23         | 2.20         | 0       | 14.50             |
| Average        | 43.74     | 82.93               | 17.89         | 1.77         | 0       | 17.16             |

The level of education was related to the mindset of farmers and how to raise livestock. The highest level of education was elementary school that was 82.93%, middle school 17.89% and high school 1.77%. The use of technology to increase productivity still did not exist at all. As stated by [6] that the level of breeders’ education was an indicator of population quality and the key in developing human resources. In general, the most education was elementary school, which was 82.93%.

The breeders’ goat raising experience in two villages had an average of 17 years. According to [7] the longer a person had the experience of raising livestock, the easier it would be to deal with the case he/she experienced. To run a livestock business, breeding experience was very much needed for its business [8].

3.1. The Natural Resource Potential
Ngemplak village is located at an altitude of 1385m asl whereas Wonoroto village is at an altitude of 1185m asl, with the conditions of the highlands, hilly suitable for the development of goats breeding. One of the causes of the low productivity of goats was the feed quality. If it did not meet the needs, it would have resulted in obstruction of estrus time, delay in puberty, estrus post-partum, inhibited fetal growth, abortion, and late growth [9].
3.2. The Calculation of Respondent's Carrying Capacity

The average of grass cultivation production in two villages was 3.34 kg/m² (Table 2 and Figure 2) natural grass was 0.81 kg/m²; and agricultural waste production was 0.43 kg/m². Then, the production of cassava waste' average was 2.8 kg/m². Whereas, the wastes in other categories’ average was 1.59 kg/m².

Table 2. The potential of main support feed resource for the goat development

| Location   | Grass (Kg/m²) | Agricultural Waste (kg/m²/year) | Land Area (m²/household head) |
|------------|--------------|---------------------------------|-------------------------------|
|            | Cultivation | Natural | Corn | Cassava/Collect | Etc. | Agriculture | Forage |
| Ngemplak   | 2.98        | 0.67    | 3.54 | 2.40           | 1.69 | 5102        | 364.25 |
| Wonoroto   | 3.70        | 0.95    | 3.34 | 3.20           | 1.51 | 3967        | 1391   |
| Average    | 3.34        | 0.81    | 3.44 | 2.80           | 1.60 | 4543.50     | 877.63 |

The average area of community agricultural land for two villages was 4543.5 m²/household head. Some of the goat's food needs were fulfilled from the land, and some others grazed on the state land (forest), the village land and the other land.

Figure 2. Carrying capacity diagram

The ownership of grass land for each household head of the average goat breeder was 877.63 m²/household head. The ownership of grass land for each household head of the average goat breeder was 877.63 m²/household head. However, the two regions utilized to grow tobacco plants around 50% annually. Based on Table 3 and Figure 3, each goat breeder's household had a food source of 1954.87 kg DM (the capacity of goats is 0.85 AU/household head).

Table 3. The average of forage production of respondents in two poor villages

| Type of feed | Production (kg/m²) | Land Ownership Width (m²) | Land Use (%) | Feed Production (kg) | Harvest Frequency (time/year) | Feed Production (DM) (kg) |
|--------------|--------------------|---------------------------|--------------|----------------------|------------------------------|--------------------------|
| Cultivated Grass | 3.34               | 877.63                    | 25           | 4396.93              | 6                            | 659.54                   |
| Lawn         | 0.81               | 877.63                    | 25           | 535.14               | 3                            | 53.51                    |
| Corn Stalk   | 3.43               | 5102                      | 25           | 8749.93              | 2                            | 874.99                   |
| Cassava Leaf | 2.80               | 5102                      | 20           | 2857.12              | 1                            | 285.71                   |
| Others       | 1.59               | 5102                      | 5            | 811.22               | 2                            | 81.12                    |
| Total of Feed Production (kg DM) |                     |                           |              | 1954.87              |                              |                           |
If calculated based on the ownership of goats, the ability of the land owned was only able to maintain 0.24 AU adult female/male (about 2 adult female/male goats), young male and female goats as much as 0.08 AU (1 virgin and 1 lamb) and male/female lamb as much as 0.35 AU (10 lambs).

![Figure 3](image.png)

**Figure 3.** Forage production diagram in two poverty village

### 3.3. The Area Capacity

Based on the monographical data, the average land in the two villages that were used and allowed to produce animal feed was 350.77 Ha (11 Ha of paddy field, 120.3341 fields, 157 plantations, 30 Ha of forest, 39 Ha of other land, 1.9 Ha of village land). Based on the use of the amount of agricultural land/fields, it was found 3% of paddy farmland, 33.5% of fields including vegetables, 44% of plantations, 8.4% of forests, other 10.9% and 0.5% of village cash land. It was an exception for Ngemplak village, where there was no paddy field, then the percentage for the field capacity prediction was 36.5% (rice fields were considered as fields).

The land use in two villages was 50% for tobacco while 50% was predicted to produce fodder; in one year, the average land potentially produced animal feed 350.77 ha. Based on the area of land capability of producing fodder forage and feed production data per m², the calculation of the capacity was shown in Table 4 and Figure 4.

| Type of feed   | Production (kg/m²) | Agricultural area (ha) | Planted area (%) | Land Use (%) | Harvest frequency (times/th) | Feed Production (Fresh) (kg) | Feed Production (DM) (kg) |
|---------------|--------------------|------------------------|------------------|--------------|----------------------------|-----------------------------|--------------------------|
| Cultivated Grass | 3.34               | 350.77                 | 36.5             | 20           | 6                          | 513.148.45                  | 102,629.69               |
| Lawn          | 0.813              | 350.77                 | 100              | 10           | 3                          | 855,528.03                  | 171,105.61               |
| Corn Stalk    | 3.43               | 175,385                | 36.5             | 50           | 2                          | 219,573.25                  | 54,893.32                |
| Cassava       | 2.8                | 175,385                | 36.5             | 50           | 1                          | 896,217.35                  | 17,924.35                |
| Others        | 1.59               | 175,385                | 19.8             | 50           | 2                          | 68,979.84                   | 16,494.96                |
| **Total of Feed Production (kg DM)** |                    |                       |                  |              |                            | **363,047.93**              |                          |

Remarks: 50% landuse of agricultural land for tobacco plants except field grass; the percentage of DM for cultivation grass and nature 20%; cassava, corn stalk and other grasses 25%.
The average production of DM feeds on Ngemplak and Wonoroto villages was 363.05 tons/year. If the consumption of 1 AU was 2.3 tons/year, then the two regions had capacity to hold livestock 315.69 AU or 157.85 AU/village. Wonoroto village had a number of goats of 3.22 AU while Ngemplak village had 9.8 AU; the total ownership was 13.02 AU.

| Goat Phase | Wonoroto | Ngemplak | Total | Average/ household head(AU) |
|------------|----------|----------|-------|-----------------------------|
| Adult Female | 13  | 38  | 51  | 7.14  |
| Adult Male | 3  | 7  | 10  | 1.40  |
| Virgin Female | 8  | 16  | 24  | 1.68  |
| Young Male | 2  | 14  | 16  | 1.12  |
| Female Lamb | 4  | 29  | 33  | 1.16  |
| Male Lamb | 4  | 11  | 15  | 0.53  |
| Total/Village | 34 | 115  | 149  | 13.02  |

Note: Calculation of AU for adult goats was 0.14, virgin goats was 0.07 and seedlings was 0.035

The sheep population as a competitor was 24.75 AU or in the average of 0.49 AU/household head. The total number of farmers who had sheep in Ngemplak village was 264 household heads; and in Wonoroto, there were 246 household heads; the total population of sheep for 2 poor villages was 510 household heads. Thus, the total number of sheep AU was 252,399. Based on the village monograph data, the total number of cattle was 42 AU. The number of the goats was 13.02 AU, the sheep as the competitors 252,399 AU, and cattle 42 AU; the total livestock in the area was 307,419 AU. The availability of feed in the two villages could still accommodate 8.275 AU goats or 59 adult goats.

| Sheep Phase | Ngemplak Village | Wonoroto Village | Total (AU) |
|-------------|------------------|------------------|-----------|
| Adult Female | 8.26  | 8.40  | 16.66  |
| Adult Male  | 1.82  | 1.68  | 3.50  |
| Young Male  | 0.49  | 0.14  | 0.63  |
| Virgin Female | 0.77 | 0.63  | 1.40  |
| Male Lamb   | 0.49  | 0.39  | 0.88  |
| Female Lamb | 0.74  | 0.95  | 1.68  |
| Total (AU)  | 12.57 | 12.18 | 24.75  |
| Average (AU/household head) | 0.49 |
3.4. The Reproductive Status of Local Female Goat

The ratio of female and male adult goats (brood and male) was found 7.14 AU vs. 1.40 AU or met the adequacy ratio for the development of goat population in an area that was 1: 7 (1 male; 7 females).

3.4.1. First Lambing Age

The age of goat first lambing at the study site was 18 months. It was influenced by many factors including the age of puberty and S/C (Services per Conception). Puberty was determined by the first estrus. This was influenced by many factors including nutritional quality, environmental factors such as a healthy enclosure, clean/sterile, weather, etc. as [10] the first mating was closely related to body maturity. The details are listed in Table 7.

### Table 7. The reproductive performance of local goats in the two studied villages

| Reproductive Status          | Ngemplak Village | Wonoroto Village | Average |
|------------------------------|------------------|-----------------|---------|
| Littersize (number)          | 1.21             | 1.42            | 1.30    |
| First age of childbirth (month) | 17               | 19              | 18      |
| KI (month)                   | 8.60             | 9               | 8.90    |

3.4.2. Kidding Interval

The kidding interval (KI) of the study result was 8.9 months. The kidding interval was a factor that determined the high and low of the average production of child produced per year; the shorter the kidding interval, the higher the yield obtained while the faster the emergence of estrus after childbearing indicated that the goat was ready to be mated again [10]. The kidding interval on goat brood was a minimum of 205 days in Kacang goat and a maximum of 450 days in Etawa goat. The length of the period of 8 matings depended on how quick the brood was pregnant again after childbearing, which in turn depended on the recurrence of the lust cycle [10]. This low reproductive performance could be caused by the feed factors [11]. Therefore the supply and feeding must be continuously carried out in accordance with nutritional standards according to body weight and age [12].

3.4.3. Littersize

From the results of study on local goats in two villages, the average of littersize was 1.3. Littersize was influenced by genetic factors besides feed and hormonal factors. As stated by [13] that Kacang goat was more prolific compared to the Boer goat species. Kacang goat, original Indonesian goat, was the most important goat in terms of number with the average number of littersize 2.2. It could birth to an average of 2 kids [1]. It had a high fertility with 1 to 4 lambs per birth. In the normal conditions, the percentage
of birth reaching 95% was normal; around 7 - 15% of female goats could birth to 3 lambs and more than 50% could birth to 2 lambs [14].

4. Conclusion
The area capacity of the two impoverished villages in the subdistrict Windusari was 315.694 AU or 157.85 AU for each. The goat livestock that could be added to the two villages was 8,275 AU or about 59 adult goats. The first childbearing age was 18 months with kidding interval of 8.9 months.

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