

Buffalo Livestock Productivity in Magelang Regency Central Java Indonesia

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Abstract— This research was conducted to prepare a master plan for the development of buffalo in Magelang Regency. The research is planned for 2 years, year 1 aims to determine the ability of buffalo productivity and feed consumption. Determination of the sample based on the area with the largest population, covering the sub-districts of Dukun, Bandongan and Secang. The selection of respondents was done by random sampling. The study used a survey method with interviews and direct measurements/observations in the field. The data measured included birth weight, weaning weight, 2-year weight, mature weight, ADG, and DM consumption. The data collected was tabulated and analyzed descriptively. The results showed that buffalo breeders in Magelang Regency had an average age of 31-50 years (65.5%), 20-30 years (13.8% and over 50 years 20.7%, the most education level was elementary school, namely 51.7%, junior high school and senior high school 48.3%, the main occupation is farmer (65.5%), with an average number of ownership of 2 tails (48.3%). Buffalo production performance for birth weight 29.54 ± 1.37 kg, weaning weight 103.38 ± 12.95 , 2-year weight 264.52 ± 51.89 kg, mature weight 372.71 ± 19.86 , ADG 0.41 ± 0.07 and BCS average 3.87 ± 0.32 . Reproductive performance at puberty (yr) 2.60 ± 0.49 , length of lust (days) 1.5 ± 0.50 , age at first marriage (year) 3 ± 0 , length of pregnancy (months) 10.3 ± 0.48 , Calf Crop (%) 74 ± 0.44 , post partum estrus (months) 4.21 ± 0.05 , post partum mating (months) 5.18 ± 0.04 and Calving interval (months) 1.55 ± 0.13 . DM consumption was 8531, 82 kg/DM/head/year. The TKT of this research activity is 4 because the results of the research can be used after the end of the 2-year implementation period. It was concluded that based on the performance of production, reproduction and the level of feed adequacy, the district of Magelang is feasible to develop buffalo.

Keywords— Buffalo, production, reproduction, feed capacity, Magelang district.

I. INTRODUCTION

Buffaloes have a fairly good level of trade in addition to cattle, sheep, poultry and other livestock. According to Singh et al., (2013) buffaloes are able to convert feed with high crude fiber content into meat and milk, as a food source of protein. Buffalo with a slaughter weight of 300 to 400 kg had a carcass of 52.83% of the slaughter weight, 67.5% of the meat, 18.4% of the bones and 15.4% of the abdominal fat from the hot carcass (Mahmoudzadeh and Fazaeli 2009). Buffalo is a genetic resource typical of the tropics and is beneficial for increasing food protein (Kandepan et al. 2009).

Operational activities for the development of buffalo livestock as stated in the Buffalo Livestock Development Plan (Ditjennakeswan, 2011) include population development, increased production and competitiveness, and increased farmer income. The buffalo farming system in Indonesia is still

dominated by small farmers using extensive and semi-intensive rearing. This has become one of the problems arising from the decline in the buffalo livestock population from year to year.

Magelang Regency has spots for developing buffalo livestock which are still being carried out extensively with very minimal productivity. Magelang Regency is home to the highest buffalo population in Central Java. The livestock potential is supported by the existence of an animal market where there are 4 large animal markets, namely the Muntilan animal market, the Grabag animal market, the Pakis animal market and the Salaman animal market, each of which can accommodate a capacity of 200 to 1000 head of cattle and buffalo. The Magelang district area is very likely to be used as a center for buffalo development in the province of Central Java. It is necessary to map the area for the development of buffalo livestock to facilitate regional planning which will have a multifactorial effect on the productivity of buffalo livestock.

The low productivity resulted in the slow development of the buffalo livestock population in the Magelang Regency area. The development of buffaloes in the Magelang Regency area really needs concrete data related to the level of production, reproduction, availability of feed, capacity and adequacy of feed. So that it can be mapped which areas are regionally ready for development while at the same time the people also like buffalo livestock as savings.

II. MATERIALS AND METHODS

The first year of research was carried out from July to September 2021 in three areas that have the largest population of buffalo in the Magelang district, namely the Dukun, Bandongan and Secang sub-districts. Materials used include buffalo breeders with a minimum number of ownership of 1 UT with a minimum of 5 years of farming experience, buffalo cattle in various phases, animal feed, fodder crop land/agricultural waste. The method in this research is a survey method through interviews and direct measurements in the field. The population used in the research sample collection was the population in the three sample districts, namely 2073 buffaloes. The three sub-districts have the highest number of buffalo populations in Magelang district.

The research sample was taken using the Slovin formula in the three densest population areas. The use of this formula is used to determine the minimum sample size needed to describe and represent the population.

Pre research stage

The sampling technique is probability sampling using proportionate stratified random sampling. According to Sugiyono (2010: 64) proportionate stratified random sampling is a technique used when the population has members/elements that are not homogeneous and proportionally stratified.

Measurement of production variables includes birth weight, weaning weight, 2 year weight, mature weight, consumption of DM, ADG and BCS. Reproductive variables, including age at first mating, age at first giving birth, birth interval, and S/C.

Research Stage

The research phase was carried out using the survey method through direct interviews with respondents and direct measurement/observation of the required data. Field surveys for buffalo production performance and measurement of feed adequacy, measuring reproductive performance and collecting secondary data from related agencies.

Data analysis

The primary data obtained was analyzed using descriptive analysis (Sugiyono, 2014).

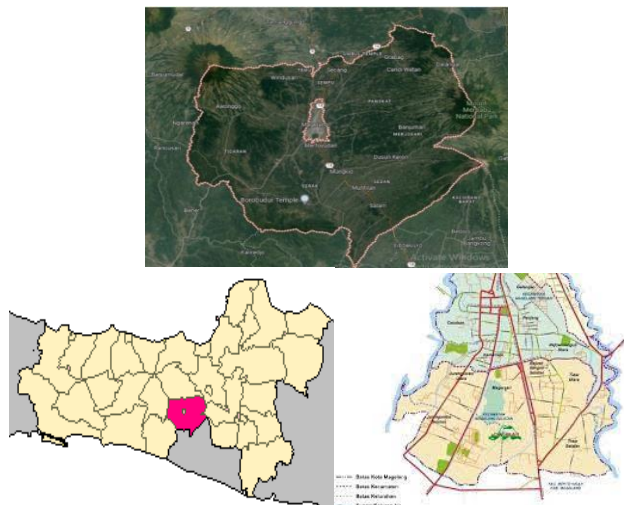


Figure 1. The research location of Magelang Regency, Central Java Province, Indonesia

III. RESULTS AND DISCUSSIONS

Results

Production Characteristics

Based on the results of research on buffalo production which includes the average body weight, ADG and BCS of buffalo in the sample area in Magelang Regency, it can be seen in Table below:

TABLE 1. Characteristics of Buffalo Production in Magelang Regency

Production Characteristics	Subdistrict			Total Average and std
	Dukun	Bandongan	Secang	
Birth Weight (kg)	9.00	29.56	29.96	29.54±1.37
Weaning Weight (kg)	109.06	101.06	101.20	103.38±12.95
2 Years Weight (kg)	287.23	256.01	255.02	264.52±51.89
Adult Weight (kg)	370.77	371.66	374.53	372.71± 19.86
Average Daily Gain (ADG) (kg)	0.44	0.40	0.40	0.41±0.07
Body Condition Score (BC)	3.92	3.83	3.87	3.87±0.32

Characteristics of Buffalo Reproductive

TABLE 2. Characteristics of Buffalo Reproductive in Magelang district.

Reproductive Characteristics	Average and Sd
Age of Puberty (years)	2.60 ±0.49
Length of Estrous (days)	1.5±0.50
Age of First Service (years)	3±0
Length of Pregnancy (months)	10.3±0.48
Calf Crop (%)	74%±0.44
Estrous Post Partus (months)	4.21±0.05
Service Post Partus (months)	5.18±0.04
Calving Interval (years)	1.55±0.13

Discussions

Birth Weight

Based on the research results in Table 1, it can be seen that the birth weight in Magelang Regency was 29.54±1.37 kg. Birth weight is the accumulation of growth since the zygote form, embryo to fetus in the womb. Birth weight of broodstock is influenced by nation, level of nutrition, number of children conceived, female age, sex and mating season. Male birth weights are 1-5 kg heavier than females, the type of birth where single birth weights are heavier than twin births due to competition for nutrient use in the uterus (Hasriati, 2001).

Birth weight is one of the important things in the growth pattern because calves with birth weights greater than the normal birth average are able to survive. The main factors that cause differences in birth weight are the genetics of males and females, age and size of the cow's body condition at conception, the quality and maturity of the eggs when fertilized, the number of calf born, the female nutrition during pregnancy, the presence of disease infections, and the stress level of the cows parent (Abdullah, 2011).

One of the factors that influence the growth and development of the fetus in the females womb is the females weight which has a positive correlation with birth weight. Larger sows will result in higher birth weights compared to small sows, as well as weaning weight for the babies born. The birth weight between births was significantly different, as well as the average weaning weight at the third birth was significantly higher than the average weaning weight at the first birth, while the average weaning weight at the first and second births was not significantly different. Thus the second and third births are not significantly different. Judging from the difference in seasons, the average birth weight of calves is higher than the average birth weight in the dry season (Karnaen and Arifin, 2010).

Weaning Weight

Based on the results of research on the weaning weight of calf in Magelang Regency, it was 103.38±12.95 kg. According to Astuti (2006) buffaloes return to heat after giving birth for 3-5 months so that the calf is released after 3 months of weaning and the females remarries. However, the fact is that the buffalo are re-mated 5-6 months after giving birth and the calf is weaned by the breeder at the age of 6 months after the female no longer wants to breastfeed.

Weaning is an important time in the life of a young animal because after the first seven or eight months it is dependent on its female for care and food. Weaning time depends on the season of birth and the local livestock system. Weaning buffalo

calf that are late in weaning can indirectly lengthen the distance between the two births because of the instinctive nature of the female to prioritize her calf, especially in environmental conditions with less food supplies. Food supply greatly determines the growth of children, especially for female who are breastfeeding their calf, because without food supplies that support milk production, there will be obstacles to the growth of calf before weaning.

There are several main factors that affect growth before weaning, namely genotype, birth weight, mother's milk production, number of children born, female age, calf sex, and weaning age (Garantjang, 1993). It is important to know the weaning weight because it is one of the indicators for selecting prospective parents, showing the ability of the female to produce milk and the ability to care for her young. Older female wean their calves higher than younger females, because there are differences in the ability to breastfeed children between old and young females, as well as the milk production of older females more than the younger ones. Weaning weight increases as the sows age increases until they reach the age of five-six years, then decreases as the sows age increases. Weaning weight is also affected by location, year and the interaction between the two (Garantjang, 1993).

Two Year Weight

Based on the results of research on biennial buffalo weight in Magelang Regency is 264.52 ± 51.89 kg. Smaller than according to (Pasha, 2012), the body weight of the buffalo at the age of 2 years is 275 kg. The low body weight of two-year-old buffalo is thought to be due to lower genetic quality in general due to inbreeding and prolonged negative selection, besides that it is also influenced by the environment, management, feed availability and disease. Buffalo production can be seen and measured by knowing body weight, body size, livestock condition and work ability. Body size which includes body length and chest circumference is a combination of parameters that are accurate in estimating the body weight of buffaloes.

Body weight increases followed by stronger and more fertile muscles so that the chest circumference increases. The age of the buffalo used in this study ranged from 6 months to 10 years. Live weight increases with age. This is clearly seen in table 1, that the older the age, the higher the body weight.

Adult Weight

Based on the results of research on the weight of adult buffalo in Magelang Regency is 372.71 ± 19.86 kg. The adult weight is not much different from that of adult buffalo which is 375 kg. Praharani and Triwulanningsih stated that the average body size of livestock in an area indicated the quality of available seed which could be used as the basis for the standard size of seed in that area. Livestock performance in general is directly influenced by the environment in their habitat and the genetic quality of their parents' inheritance.

Gender can cause differences in growth rates. The difference in growth rate between the two sexes can be greater with increasing age. Sex steroids are involved in growth regulation and are primarily responsible for differences in body composition between the male and female sexes. Feed factor is very important in meeting the needs of growth. Lack of feed is

a big obstacle in the growth process. Especially if there are very few nutrients in the feed for growth, such as protein, minerals and vitamins.

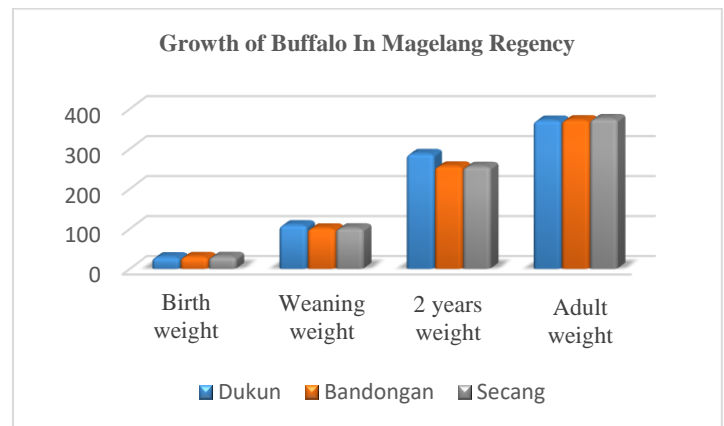


Diagram 1. Growth of Buffalo in Magelang Regency

Average Daily Gain (ADG)

Based on the results of research on the Average Daily Gain (ADG) is one of the parameters to see the productivity performance of a livestock. The average ADG of buffalo in Magelang Regency is 0.41 ± 0.07 kg. The results of Yurleni's research (2013) improved the quality of buffalo feed by bathing every day resulting in ADG 1.2 kg higher than PO cattle with ADG 0.9 kg. This shows that the feed efficiency of buffalo is higher than that of cattle. The temperature in Magelang district is around 26°C which is very suitable for buffaloes with sufficient forage conditions and the addition of rice bran as a by-product of rice, it is hoped that the buffalo's performance can be improved.

The growth rate is influenced by sex, hormones, feed, genes, climate and parent health (Hashaider, 2007). Alluding to the role of hormone factors, their activity in growth depends on several factors involving food supply, genetic potential, and the environment. Directly or indirectly these hormones can change biochemical reactions related to the process of growth and development of body components. Hormones that affect growth can be divided into two groups, namely the anabolic group, including somatotropin, testosterone, and thyroxine, and the catabolic group, including estrogen. Hormones that directly affect growth include somatotropin, thyroxine, androgens, estrogens, and glucocorticoids. Somatotropin hormone is synthesized during prepuberty and puberty.

Body Condition Scoring (BCS)

The BCS of the buffalo in Dukun, Bandongan and Secang Districts were 3.92, 3.83 and 3.87 with an average of 3.87 ± 0.32 . BCS in Dukun sub-district was higher than BCS in Bandongan and Secang sub-districts. Feed management factors greatly affect BCS.

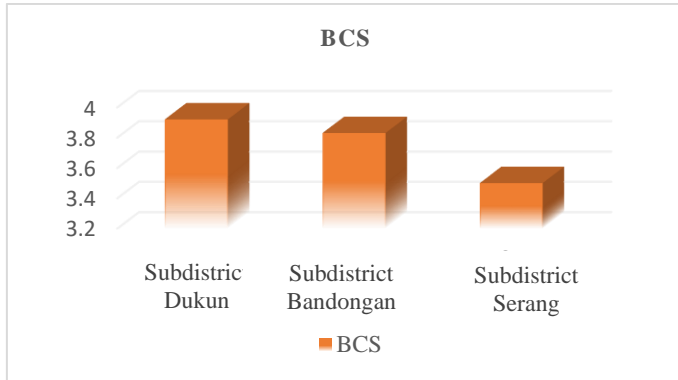


Diagram 2. Buffalo BCS in Magelang Regency

The body condition score factor is one of the factors that affect the Calving Rate, livestock with high BCS tend to contain a lot of fat in their bodies. High fat content can cover the reproductive tract so that there will be impaired function of the reproductive organs, however, low BCS will also cause a decrease in the body's ability to form reproductive hormones and disrupt ovulation. According to Bearden and Fuquay (1984), if there is accumulation of fat in the reproductive tract due to obesity, it will cause disturbances of the estrus cycle, low pregnancy rates, dystocia, abortion and placental retention. BCS value of three (moderate), female buffalo in Magelang Regency are very good as parents. Good morphometric performance affects the achievement of good body weight at a younger age, so that buffalo can be mated at a younger age.

The results of this research show that there is still a chance to accelerate the first heat and age at first mating, if the quantity and quality of the buffalo feed is increased. The higher the BCS value, the higher the body weight. The body weight of female buffalo in the lowlands is around 300 kg, while in the highlands it is around 500 kg with the same BCS of 3.8. This is due to the higher age variation in female buffalo in the lowlands, one was found to be 17 years old and one with a BCS of one (very thin).

Characteristics of Buffalo Reproductive

Reproduction is a bodily function that is very important for the continuation of the offspring of a type or nation of animals. Mating is generally done naturally by borrowing and borrowing a male buffalo as a companion when the adult female buffalo is in estrus. The following is a table of reproductive characteristics in Magelang Regency (Toelihere, 1981).

Age of Puberty

Based on research (Table 2) shows that the average age of puberty of buffalo in Magelang Regency is 2.6 years. Puberty occurs because it is influenced by animal factors including age, body weight, race and genetics. Some of the factors that are also very influential are the adequacy of feed (nutrition), the environment, namely: temperature, season and climate. Early puberty will be beneficial because it can reduce the unproductive period and extend the productive life span of livestock. Another word for puberty is sexual maturity which indicates that the reproductive organs begin to function normally to produce germ cells (sex cells or ova in females).

Genetic improvement can occur more quickly because the generation interval is shorter, if the selection is carried out properly and the selection program is effective (Tomaszewska

at al., 1991). This study is in accordance with Rohaeni et al. (2008) which states that the age of puberty or the age of the first lust is 2-3 years.

Length of Estrous

Based on Table 2, the average duration of heat for buffalo in the Magelang district is 1.5 days. The duration of lust ranges from the time the female accepts the male until the final rejection. It is suspected that the length of time for lust is influenced by genetics and buffalo feed. Williamson and Payne (1993) state that the factors that most influence the heat cycle apart from abnormalities due to disease are the level of feed, the length of the day and ambient temperature. This study is in accordance with Rohaeni et al. (2008) which stated that the buffalo maturation period is 36 hours or equal to 1.5 days.

The duration of lust determines the exact moment of marriage. If the marriage is carried out naturally, then the constraint on whether or not the mating time is correct is removed, because the male buffalo as a pempek will know when the marriage is carried out. This is caused by the information that the female buffalo wants to mate or estrous conveys through a hormone called pheromone.

Age of First Service

Based on the results of research on the age of first service buffalo in Magelang Regency, it has an average of 3 years (Table 2). Age of first service is closely related to puberty which is marked by the appearance of the first estrus (estrous). The difference between the ages of puberty and the age at first service is usually caused by the lack of knowledge and attention of breeders regarding this matter, also due to the silent heat characteristic of buffaloes.

Signs of heat in buffalo are almost the same as in cattle, but not as obvious as in cows (Sosroamidjojo and Soeradji, 1990) and signs of heat become less pronounced during the dry months from April to June and are often called silent heat (Ranjhan and Pathak, 1979). Young female animals should not be mated until their body growth permits (body maturity is reached) for a normal pregnancy and birth. This is because sexual maturity occurs before body maturity is reached (Toelihere, 1981). The results of the study are in accordance with Rohaeni et al. (2008) that the buffalo's first mating age is around 2.5 -3 years.

Length of Pregnancy

Based on the results of research on the length of pregnancy of buffalo in the Magelang Regency area, it has an average of 10.3 months or 309 days (Table 2). Factors that affect the duration of pregnancy are the sex of the offspring, heredity (factor G), the age of the female and more broadly, namely the season of birth and environmental conditions.

Gestation by sex of male offspring in mammalian species generally lasts slightly longer than that of females. Besides that, the first pregnancy is generally shorter than subsequent pregnancies (Fahimuddin, 1975). The results of this study are in accordance with Toelihere (1981), which stated that the average pregnancy period was 310-315 days and further stated that differences in pregnancy age could also be caused by factors such as rearing management, feed adequacy and environmental climate.

Calf Crop

Based on the results of the study, it was shown that the calf crop of buffalo in Magelang Regency was 73%. The calf crop in Magelang Regency is considered high because the calves receive good care and the accuracy of disease control by farmers when the calves are attacked by disease.

The punctuality of mating is one of the factors that influence the high harvest of children in Magelang Regency. This is due to the colony grazing system and the availability of many male buffalo as pempek. Another factor that affects the harvest of tillers is the rare occurrence of disease in both female and male pempek. Illness and disease affect the harvest of children, because they can result in non-fertilization in the uterus, fetal death, calf death both before and after partus (calf mortality). If you want a high calf crop rate, you must pay attention to the time and duration of heat, accuracy during mating, nutrition and disease control (Talib, 1988). The results of the calf crop study in Magelang Regency were higher when compared to Komariah's research (2014) in the Kutai Kartanegara Regency which only achieved 67%.

Estrous Post Partus (Estrous Post Partus = EPP)

Based on the results of the study it is known that estrous post partus to an average of 4.2 months. EPP is heavily influenced by environmental factors such as feed, comfort in the cage and the presence of certain reproductive diseases or disorders, which will inhibit the emergence of hidden lust or lust (silent heat). Weaning time for puppies that is too long is also one of the causes of delayed re-estrus after calving, especially if the feed intake is insufficient during lactation.

At the time of childbearing or parturition that runs normally will occur if the pregnancy period is sufficient. The reproductive organs, especially the uterus, will experience a process of returning to their original shape or returning to their original size before pregnancy. This process is known as uterine involution. Usually the appearance of lust again will occur after uterine involution is complete. Uterine involution in buffalo is about 2 months (60 days). The process of estrus after giving birth in each individual varies depending on the duration of the uterine involution process and other environmental factors.

Buffaloes are like cows in that if in post-calving management the female are faced with insufficient feed, a non-compatible environment, poor sanitation in the stables or other unfavorable conditions, the mother will experience disturbances in the subsequent reproductive process (Hardjopranjoto, 1991). Furthermore, according to Williamson and Payne (1993) stated that the most important factors affecting the lust cycle apart from abnormalities due to disease are the level of feed, length of day and ambient temperature. The results of the research on estrous post partus to buffaloes in Magelang Regency are faster than Komariah (2016), which is 5.5 months.

Service Post Partus

Based on the results of a service post partus to buffalo in Magelang Regency, 5.18 months. After the buffalo experiences heat again after giving birth, a natural service is carried out. The delay in post-calving female buffalo mating is caused by the timing of the emergence of lust and the length of the lust cycle which the farmer does not know. This is due to the lack of knowledge and attention of breeders to the female buffalo,

besides that it is also caused by the silent heat of the buffalo.

Signs of heat in buffalo are almost the same as in cattle, but not as obvious as in cattle (Sosroamidjojo and Soeradji, 1990) and signs of heat become less pronounced during the dry months from April to June and are often called silent heat (Ranjhan and Pathak, 1979). Service post partus is very necessary for the productivity of buffalo livestock. As Putu's research (2003) stated, buffaloes are service post partus to an average of 4.95 months. Service Post Partus is influenced by the emergence of lust which can be observed by breeders, the factor that most influences the emergence of lust is hormonal factors. As long as buffaloes have enough food, reproductive hormones are available to cause lust (want to mate).

Calving Interval

Based on the research results in table 2, the calving interval for buffalo in Magelang Regency averages 15.55 months. The success of raising livestock is related to its reproduction, which is measured by its ability to produce offspring within a certain period, meaning that the shorter the spacing between children, the better the reproductive performance or reproductive efficiency.

Calving intervals are more regulated by environmental factors, namely the opportunity to reduce tillers with the efficiency of maintenance management and proper or sufficient and perfect feeding as mentioned by Fahimuddin (1975). The calving interval or calving interval is influenced by factors such as silent heat, estrous time after giving birth, re-mating after giving birth, S/C and duration of pregnancy. Feeding that does not meet the needs and the amount of energy that must be expended when working in the fields/fields, triggers the emergence of silent heat so that mating will be delayed.

Adequacy of Feed

Based on the research results, table 3 shows that the consumption of DM is 23.6 kg of DM/day or 8,531.8 kg of DM/year. Consumption of dry matter 6.35% of the average body weight of 372.71 kg. The results of this study are greater than those of Talib et al. (2014), which states that the consumption of dry matter (DM) for buffalo is 2.7-3.5% of body weight.

TABLE 3. Consumption of Buffalo Feed in Magelang Regency

No	Feed Type	Total (DM/Kg/Day)	Total (DM/kg/year)
1	Paddy Straw	20.50	7396.10
2	Grass Superior	1.50	545.30
3	Field Grass	1.60	590.40
	Total	23.60	8531.80

Buffaloes in the Magelang area are generally fed fresh grass and paddy straw. Besides that, buffalo are also reared by grazing during the day until evening in grazing land and rice field bunds, then they will be kept in pens at night. In general, the pattern of raising buffalo in the Magelang Regency area is semi-intensive, meaning that some farmers still manage feed, reproduction and disease control.

The majority of types of feed provided by breeders are paddy straw, this is because the Magelang Regency area has a fairly large production of agricultural waste in the form of paddy straw every year. According to Koddang (2008) paddy straw contains 84.22% dry matter (BK). The high consumption

of buffalo dry matter in Magelang Regency is due to the majority of the feed consumption given is paddy straw which has a relatively high dry matter content. This shows that the consumption of BK buffalo in Magelang Regency is sufficient.

From the results of research on the Buffalo Livestock Development Master Plan in Magelang Regency, it can be concluded that: 1) Performance of buffalo production in Magelang Regency, average birth weight 29.54 ± 1.37 kg, weaning weight 103.38 ± 12.95 kg, weight 2 years 264.52 ± 51.89 kg, adult weight $372, 71 \pm 19.86$ kg, ADG 0.41 ± 0.07 kg/day and BCS 3.87 ± 0.32 . 2) Reproductive performance of buffaloes in Magelang Regency; puberty 2.6 years, estrus 1.5 days, first marriage 3 years, gestation 10.3 months, calf crop 74%, heat after calf 35.18 days, interval at first mating after calf 35.97 days, calving interval of 13.02 years. 3) Consumption of BK per year for buffalo at the farm level is well fulfilled.

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