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Review Article

Benefits of the System Integration Crop-Livestock-Forest for Animal Production

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Abstract

In search of viable alternatives to meet the demand for agricultural products that cause fewer environmental impacts, the crop-livestock-forest integration system has been gaining space for those seeking short-term financial returns. With ISS, the objective of this study was to evaluate the influence of the coexistence of crops provided by the crop-livestock-forest Integration System (ILPF) in the development of *Brachiaria* grasses used for Animal fodder. For this, A bibliography review study was conducted to better understand the theme. Thus, in view of the above, it was possible to verify that among the most used grasses in this system is the genera *Brachiaria* and *Panicum*, because they are more tolerates to the shading. And related to the thermal comfort of the bovine, it was explicit that the trees provide this comfort in the ILPF, resulting in faster weight gain and meat with better flavors.

Keywords: *Thermal Comfort; Animal Forage; ILPF*

Introduction

The present study was timely in view of the increasing search for viable alternatives to meet the demand for agricultural products that cause fewer environmental impacts, since there are several problems of decades of practices Non-sustainable agricultural crops such as deforestation, monoculture that leads to erosion and loss of soil fertility, siltation of water courses, soil and water pollution and greenhouse gas emissions.

Thus, it was intended to present the crop-livestock-Forest Integration (ILPF), which aims to meet the new sustainability parameters in order not to decline productivity, by seeking the intelligent interaction between cultures. For this purpose, it was sought characteristics of grass of the genus *Brachiaria*, such as physiology and nutritional factor for livestock animals and the interaction between these beings in a forest environment.

In view of the above, we expect to answer: “What is the nutritional performance of *Brachiaria* grasses, used for animal feed, in the crop-livestock-forest integration System?”.

The general objective of the study was to evaluate the influence of the coexistence of crops provided by the crop-livestock-forest Integration System (ILPF) in the development of *Brachiaria* grasses used for animal forage.

In addition, the specific Objeti were intended in 3 chapters, respectively: to present THE ILPF from a brief historical perspective and its application in the current context; morphologically characterize grasses of the genus *Brachiaria* In order to theorize the types, spacemen To and start more efficient trees to grow these in THE ILPF system and ultimately evaluate their benefits for animal feeding and welfare obtained through the integration of crops.

The methodology used as the basis for the study was the review Bibliographical in articles, books and database on the Internet, seeking terms such as integration systems, agrolivestock sustainability, innovative farming practices, shading and Animal forage, in order to find results of ILPF system applications and benefits of this for animal nutrition and productivity. The research was carried out in the Scielo database, seeking work with dates between 2002 and 2019. Brief history of the crop-livestock-forest integration

It can be understood the integration crop-livestock-forest as being a "production strategy employing the principles of sustainability that allows the production, in the same area, of grains, meat, milk, fibers, energy and Wood" (Brazilian company of Agricultural research-EMBRAPA, 2016, p. 35) crops may be intercropped in succession or rotation.

The ILPF is a strategy aimed at sustainable production, which integrates agricultural, livestock and forestry activities carried out in the same area, in consortium, in succession or rotational cultivation, and seeks synergistic effects between the components of Agroecosystem, contemplating the environmental adequacy, the valorization of man and the economic viability ([1], p. 27).

Agriculture in Brazil is documented from the arrival of the Portuguese in THE 16th century and was "based on technology that used land and work, and the Earth as synonymous with natural resources" ([2], p. 15). Emphasizes Balbino., *et al*. ([1], p. 6) that European immigrants brought to the country the integration between agriculture, livestock and forest, which was being adapted to the tropical climate.

Thus, the integration of cultures characteristic of modern ILPF was already used in the pre-colonial period, although presumably in a primary way since the conditions for planting in the country were different from those that immigrants knew on land European Union.

According to Buanain., *et al*. [3] apud Filho (2014), it is identified that from this moment until around 1960, when the Brazilian urban population already exceeded the rural, the production of agricultural inputs in Brazil was sustainable because it was able to Supply the domestic market and offer the country important role in the scenario of exporting products such as sugar cane and coffee.

National agricultural incentive programs, such as Rural credit and Protocol have contributed to the economic strengthening and expansion of the sector, the lack of sustainability parameters has led to the outbreak of harmful practices to natural resources. According to Franca and Silva ([4], p. 6) "All over the world predominates Agriculture characterized by standardized and simplified monoculture systems, but which has given signs of saturation due to the high demand for energy and resources Natural resources".

According to the authors, the low level of use of good agronomic practices has resulted in degradation of soil quality, low productivity and triggering of erosion processes, jeopardizing the economy and quality of life of Future generations. In this way, it emerges as the tariff modes of production that recover spaces and/or diminish impacts to the environment.

ILPF as practice sustainable

The term sustainability has been commonly adopted as an evaluative connotation because it suggests something that can be carried forward in a fluid way. For agronomy, this means a practice that will only be verified if "(i) is technically efficient, (II) Environmentally appropriate, (iii) economically viable and (iv) socially acceptable)" ([1], p. 24).

The degree of concern with the wear of natural resources stems from efforts in attempts to reverse situations in which the damages arising from unsustainable activities are environmental, social and economic. In view of this, the International Union has established goals and parameters that define measures to be fulfilled by nations. Like this: In 1992, the United Nations Conference on the Environment, Rio 92, took place in the city of Rio de Janeiro, from which it was concluded that the economic, environmental and social components should be aggregated to ensure sustainable development and was agreed Whereas developing countries would receive financial and technological support to achieve another model of sustainable development [4].

In the national scenario, there is also the plan for reducing greenhouse gas emissions in agriculture-plan ABC (Low carbon agriculture)-created in 2010 by the Federal government, in order to enable the reduction of greenhouse gas emission in Agricultural activities; Reduce deforestation; Increase agricultural production on a sustainable basis; the rural properties to environmental legislation; Expand the area of cultivated forests and stimulate the recovery of degraded areas.

Thus, structured in seven programs, the ABC plan contemplates: 1) recovery of degraded pastures; 2) Integration of Lav Oura-Livestock-Forest (ILPF) and agroforestry Systems (SAFs); 3) No-tillage system (SPD); 4) Biological nitrogen fixation (FBN); 5) planted forests; 6) treatment of animal manure; and 7) adaptation to climate change.

These guidelines support research in relation to the agrosilvopastoral system because it confirms that it is sustainable because it is properly proceeded, according to Balbino., *et al*. ([1], p. 24):

1. Technically efficient because it is part of the premise of being carried out in areas with favorable abiotic conditions such as corrected soil, adequate irrigation, non-limiting temperature and light, as well as correct soil and water management, integrated control of insects and Pests, encouraging compliance with environmental guidelines and production certification.
2. Environmentally appropriate to have as a principle respect for land use capacity, soil and water conservation, carbon sequestration (CO_2) and positive enlargement of the energy balance.
3. Economically viable because it is grounded in the sine Georgia between the productions, providing the use of agricultural waste, nitrogen fixation, nutrient recycling, diversification of revenue in intelligent use of space, direct reduction of the cost Total through the use of residues for animal Nutrition and the offer of better pasture leading to increased profit and boosting the sectors of the economy.
4. Socially accepted, therefore, can be employed independently of the size of property and producer, generating jobs and improving local income, improving the image of agricultural production and agribusiness in the country and encouraging good farming practices (BPA).

Therefore, it is noted that the ILPF is a necessary practice in the current context both because it values ethical principles comp actuated globally from the use of resources, and because it is efficient for the environment and for society in general. The incentive of the competent institutions and the implementation of legal norms has fomented researches in the area of integrated production modes, especially those that investigate the results of the ILPF.

General benefits of ILPF application

It is known that in addition to being in accordance with the principles of sustainability, the agrosilvopastoral system is characterized by enabling protocooperation, providing the civic use of resources. Such dynamics are able to reduce the use of chemicals to control pests and weeds by inserting natural predators into the system. Moreover, there is a significant reduction in the emission of greenhouse gases through carbon sequel, intensification of nutrient cycling and improvement in nitrogen fixation in the soil ([1], p. 35).

According to Nicodemo and Santos [5], among the benefits of the adoption of silvopastoral systems can still be highlighted "the increase in the efficiency of land use; Favoring the cycle of nutrient renewal in the soil; Beneficial effects on animal welfare; Flexibility in the use and increase of biodiversity ".

Regarding animal welfare, the biologist and researcher Lex Melotto of THE MS Foundation states that trees can "mitigate the climatic extremes by presenting a reduction of eight degrees in the hottest hours of the day and an increase of up to six degrees on the colder days of Year" (Fama Sul, 2012), thus avoiding the energetic Degas with heating and body cooling of the animals, resulting in better quality meat.

However, it is necessary to emphasize that for the implantation of integrated systems, the correct management of trees, animals and pasture is beneficial, together with careful planning. Although homeostasis occurs naturally, this is a type of dynamic system in which human interference must be made to maximize the benefits achieved ([5], p. 18).

In short, prior to the choice of components, one should study the factors of the environment appropriate to the needs of the chosen species, the best interaction between the species and the medium, the nutritional characteristics of the cultivation destined for forage, the Shading, the crop period of the grasses and the start of the trees. Only from these care is it possible to succeed in the final products cultivated in the integrated system.

Cereals and ILPF

The crop-livestock-forest Integration (iLPF) figure 1, has as its main objective the change of the land use system, based on the integration of the components of the production system, aiming at achieving increasing levels of quality of the Product, environmental quality and competitiveness. Therefore, it presents itself with a strategy to maximize desirable effects in the environment, combining the increase of productivity with the conservation of natural resources in the process of intensification of the use of areas already decorated in Brazil [6].

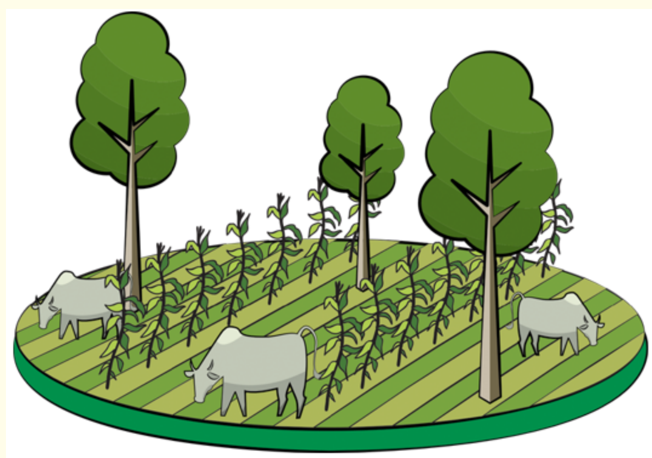

Figure 1: *Scheme ofiLPF System.*

Source: Globo Rural.

Thus, the planting of crops is used for grain production to amortize part of the costs of recovery or the reform of pastures. In degraded pastures, grains are cultivated for one, two years or more years, and volis with the pasture, which will take advantage of the residual nutrients of crops in forage production. To avoid another cycle of degradation, it is necessary to elaborate a schedule of maintenance fertilization of the newly implanted Pasture [7].

Aiming the cattle cultivation in the ILPF, it is necessary to choose the forage to be cultivated. To this end, it will depend on the climate and soil conditions of the region, as well as the purpose of use and the life cycle (duration) of the pasture. Depending on the fashion ability of the ILPF system, most of the tropical (perennial or annual) forage adapted and recommended for conventional (single) cultivation systems may be used.

One of the main factors for the success of an intercropping is based on the complementation among the species involved, since, during part of its cycle there is a competition/interaction by the factors of production (light, water and nutrients), which will Result obtained at the end of the annual crop cycle. Dess the way is important to characterize the species that will compose the system [8].

However, the most used forage are those of the genera *Urochloa* (syn. *Brachiaria*) and *Panicum* are the most used for seedings in monocultive after tillage. For consortium seedings, especially with maize and sorghum crops, both in the crop and in the Safrinha, preference is given to forage that exert less competition with the crops, such as: *Urochloa brizantha* (CV. Marandú, CV. BRS Piatã and CV.

BRS paiaguás), *Urochloa decumbens*, *Urochloa ruziziensis* and *Panicum maximum* cv. Massai. Pigeon pea cultivars such as BRS Mandarin, which are leguminous, can also be used in consortia with maize and *Brachiaria*, for silage and/or grazing production, with the purpose of increasing forage production and quality [9].

In this perspective, Gontijo Neto., *et al*. [8] describes that perennial forage (capins) used in grazing in Brazil (*Brachiaria* and *Panicuns*), since the shading is not very intense, are able to maintain the same productivities in relation to Monoculture systems. In the iLPF system, in addition to guaranteeing animal production, they act as nutrient recycler after the annual culture; In the physical structuring and contribution of organic matter in the soil; in the production of straw for the no-tillage with quality in the following crop; May contribute to weed and disease management, preserving the productivity of the annual crop and reducing Production costs; provides monthly or yearly revenue generation up to the maturation of the forestry component.

Andrade., *et al*. [10] reports that one of the fundamental requirements for the success of the iLPF systems is the choice of forage species for the system, which comes to be productive, in addition to shading-tolerant, and adapted to the conditions of the implantation site. This is more relevant in the area of Cerrado, with particular characteristics of acidic soils, low fertility and this well-defined and prolonged dry matter [10].

For this purpose, the ILPF system presents morphological differences between the arboreal component and the forage, both in the aerial part and in the root system and because they are dividing the same space, they meet their needs by exploring the same sources of Light, water and nutrient resources. Thus, it is important to know the basic mechanisms of this competition, aiming to maximize the organic production [11].

Thus, the determination of spacings and arboreal arrangements should be able to promote a quality forage accumulation along the cycle; allied to the recommendations of frequency and intensity of pasture defoliation, from the accumulation of photo assimilates By shaded plants, sufficient to provide a rapid regrowth and ensure the persistence of forage in a shaded environment [12].

In which the arboreal component should be selected taking into account the aspects related to SILvicultura of the species, production of goods and services, absence of allelopathic effects and toxicity, canopy architecture that should preferably be Less dense, among others. The most used species in the ILPF in Brazil are Eucalyptus, Pinus, mahogany AFR, Australian cedar, Teak, Pau-de-Balsa, acacias, among others [8].

In this way, the grasses of the genus *Brachiaria*, about 90 species, commonly called *Brachiaria,* have markedly tropical distribution, with the primary origin being the Equatorial Africa. The grasses of the genus are widely used in pastures in Tropical America and since they are well managed, they present high dry matter production and efficiency in soil cover [10].

However, according to Paciullo., *et al*. [13] Grasses growing under shading conditions have a reduction in the area index (LAI). However, even with practically half of the LAI, plants under the canopy of trees are able to intercept the same radiation portion as the plants that developed under full sunlight conditions, because there is a significant increase in the leaf area (AFE), indicating the increased efficiency of radiation utilization available under shading conditions.

Dias Filho., *et al*. [14] reports that grasses produced in shaded environments generally show higher crude protein content, higher non-protein nitrogen content, thinner cuticles, wider blades, stimulated elongation and development Vascular decreased. However, as the level of shade increases, the concentration of soluble carbohydrates in the plant decreases and there may be a concomitant decline in cell wall content. The components of the cell wall are an important manufacturer of forage quality, since they influence digestibility and dry matter intake.

Shaded grass leaves tend to be more efficient in the production of photo assimilates due to their morphophysiological modifications that included in the increase of the specific leaf area, Granos of the larger and less stacked thylakoid and with greater Concentration of Chlorophylls (Kirchner., *et al.* 2010), which results in a higher nitrogen concentration.

Another relevant aspect to be considered is that norm in ILPF Systems is that the number of years with pasture can be more than 3 years, and to avoid another cycle of pasture degradation, it is necessary to perform maintenance fertilization to keep them Productive. Thus, with the well-established pasture, it is interesting to establish the comfort of the bovine.

Bovine component in the ICLF

Although the systems in integration have been created in order to recover degraded soils and pastures, these systems have also been highlighted by improving the microclimate and providing thermal comfort to the animals, since the presence of the component Arboreal reduces the incidence of solar radiation by modifying the temperature and relative humidity of the air (Baliscei, 2011; Karvatte Jr., *et al*. 2016).

Thermal Comfort refers to the state in which the organism is located when the thermal balance is null, that is, when the heat that the organism produces in addition to what it gains from the environment is equal to the heat lost through conduction, radiation, convection and evaporation. For its vEZ, thermal stress is the strength with which the components of the Thermal Environment Act on the organism, in which it will provoke a physiological reaction proportional to the intensity of the applied force and the organism's ability to dissipate the deviations caused Perça [15].

Under proper management, the integration production systems promote direct and/or indirect improvements of zootechnical and environmental order. Noteworthy are also improvements in the quality of grasses in some of these systems, resulting from the being and the greater availability of nutrients in the soil that, associated with greater thermal comfort of the animals, indicate the possibility of increase in Forage intake and individual weight gain [16].

Integration production systems promote direct and, or indirect, improvements in zootechnical and environmental order. Above all, improvements in the quality of grasses in some systems, resulting from shading and greater nutrient availability in the soil. These factors are associated with the greater thermal comfort of the animals, allowing the increase in forage intake and individual weight gain [17]. However, there is still little performance information for cattle in integration systems.

In this way, the recovery/Indirect renovation of pastures by means of the crop-livestock integration is an efficient but complex alternative. In this modality the introduction of crops is not possible, but a constant part of a system of grain production and animal production that in Teragem and complete in aspects of management, fertility, Physics and soil biology (Macedo, 2009).

Thus, the trees, because they are the longest component of the system and define microclimatic conditions in the understory, are always the target of prominent attention, little emphasizing other components, such as the animal. For this, the main effect of the presence of trees is undoubtedly the improvement of environmental conditions and consequently, of their well-being. This is mainly due to the greater supply of shade and reduction of temperature and humidity, resulting in increased productivity and reproduction of ruminants in tropical environments [15].

By modifying the surface where they are installed, the silvopastoral or agrossilvipastoris systems alter the transfer of solar radiation through shading (restricting the radiation incidence) and reflection of radiation through the canopy of the trees (Figure 2) (Porfírio Da Silva., *et al*. 2004).

In fact, the arboreal component exerts beneficial effects on the microclimate of pastures by acting directly in the reduction of the incidence of solar radiation and in the energy balance of the system, with modifications of air temperature and humidity, directly related With environmental quality and animal thermal comfort (Souza., *et al*., 2010; Baliscei, 2011). Consequently, its influence and its effects will be greater and more effective and proximity to the equator, where the amount of solar radiation that reaches the terrestrial surface reaches maximum and constant values throughout the year.

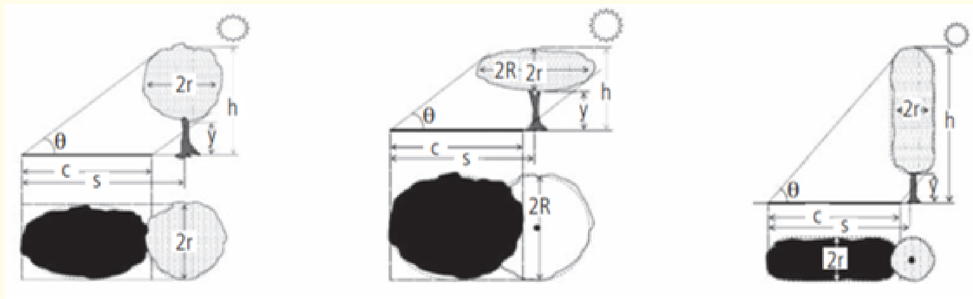

Figure 2: *Shadow projections of Arbó species areas with cups of different geometric shapes.*

Source: Silva (2006).

Thermal comfort indicators can be obtained through: environmental data (Temperature and Humidity Index – ITU, Black Globe temperature index and humidity – ITGU etc.); physiological parameters (rectal temperature, respiratory rate, Heart rate, sweating rates etc.) and/or; Behavioral variables (stereotyping or modifications in the Behavioral repertoire) [17].

This improvement in the microclimate is observed both in systems in integration with native trees and with trees cultivated in different arrangements, which can reduce the ambient temperature from 2 to 8ºC to the bra sound in relation to the full sun [17]. Changes in the Black Globe temperature are also observed where, in summer, it is possible to obtain a difference between shade and sun of about 6ºC, which would cause the increase of 1ºC in the rectal temperature and almost the DOB of Respiratory movements (Collier; The Beede; Thatcher, 1982). Similarly, there is a tendency to higher rate of sweating in animals in pastures without shading when compared to those in silvopastoral systems (Pires., *et al*. 2008).

The combination of environmental variables (temperature, relative humidity, wind velocity) compose indexes that characterize the environment and estimate the thermal sensation of the animal, which makes it possible to indicate whether or not it is in a state of comfort. Based on the ITU, the environment can be classified as: Mild (72 to 78), moderate (79 to 88) and severe (89 to 98) (Wiersma apud Armstrong, 1994). In turn, from the ITGU, the environment divides into: comfortable (up to 74), alert (75 to 78), dangerous (79 to 84) and emergency (greater than 84) (Baêta, 1985). Both classifications were developed for lactating cows confined in the United States but are widely used for cattle in several systems (Volpi, 2017).

The current agricultural practices, characterized by standardized cysts and monocultures, reached a level of primor where effort is needed to increase production without the threat of biodiversity (Balbino; Martinez Galerani, 2011). In view of the need for systems of higher total productivity per unit of area, the production system in crop-livestock-forest Integration (ILPF) aims at sustainable production through the integration of agricultural activities, livestock and Forest in the same area, in intercropping, in succession or in the field, seeking synergistic effects between the components and contemplating the environmental adequacy, the valorization of Man and the economic viability (Balbino; Babu Stone, 2011).

Although the effects of thermal stress are more evident in cattle law-making, which immediately reduce milk production, beef cattle are also affected; However, the effects will be quantified more late, sometimes only at the time of the slaughtered or never quantified. Even cattle tolerant to tropical climate, as is the case of Zebu, when kept under high temperatures and low relative humidity (35ºC and 50%, respectively), produce meat with higher pH in post-mortem (Kadim., *et al.* 2004). This, in addition to influencing softness, also results in a product with low consumer acceptance due to darker coloration and shorter shelf life, characteristic of DFD (dark, firm, dry) meats.

Although animal welfare (BEA) is not something marketable, as society starts to reconsider the way animals are created as an important factor, it becomes economically valued (Molento, 2005). Among the five global market trends, two deal with "reliability and quality" and "sustainability and ethics", which indicate the position to pay more for higher quality products and the engagement of consumers for social and environmental benefit. In Brazil, these attitudes cover about 23% and 21% of the consumer market, respectively, with a strong growth trend (FIESP/ITAL, 2010). Therefore, providing quality of life to production animals, besides being an ethical and moral issue, is also a market demand [18].

Final Considerations

In search of viable alternatives to meet the demand of Agropecuary products that cause fewer environmental impacts, the system of crop-livestock-forest integration, has been gaining space for those seeking financial return in the short term.

In view of the above, it was possible to verify that among the most used grasses in this system is the genera *Brachiaria* and *Panicum*, because they are more tolerant to shading. And related to the thermal comfort of the bovine, it was explicit that the trees provide this comfort in the ILPF, resulting in faster weight gain and meat with better flavors.

Bibliography

1. Balbino LC., *et al*. "Marco Referential Integration crop-livestock-forest". EMBRAPA (2017): 132.
2. IPEA. Institute of applied economic Research. "Agriculture and industry in Brazil": Innovation and competitiveness. Brasilia: (2017).
3. Buainain A M., *et al*. "The rural world in the21st century Il Bras: The formation of a new agrarian and agricultural standard" (2014).
4. Franca T JF and Silva J R. "The System Integration Crop-Livestock-Forest (ILPF) in the State of São Paulo". *Economic Information* 47.1 (2017).
5. Nicodemo M L F and Santos C E. "Arborization of pastures: diversification and increased productivity". In: meeting on sustainable farming production. Campinas. Anais. Campinas: IAC/APTA (2011): 15-21.
6. Trecenti R., *et al*. "Crop-Pecuáriasilvicultura integration". In: crop-Livestock-Forestry Integration: Technical Bulletin". Trecenti R. Oliveira MC; Harse G (editors). Brasilia: MAPA/SDC (2008): 54.
7. Alvarenga RC., *et al*. "Crop-Livestock integration". In: Beef Cattle Symposium. 3 Annals. Belo Horizonte, MG: UFMG, CD ROM (2004).
8. Gontijo Neto MM., *et al*. "Integrated crop-livestock-forest in Minas Gerais". In: Alves FV.; Laura VA.; Almeida RG. (Ed.). Agroforestry Systems: sustainable farming. Brasília: Embrapa (2015): 29-44.
9. Viana MCM., *et al*. "Experiences with integration Lavourapecuária system-Forest in Minas Gerais". *Report Agropecuário* 31 (2010): 98-111.
10. Andrade CMS., *et al*. "Performance and six single or intercropped grasses with Stylosanthes guianensis cv. Mineirão and Eucalyptus in silvopastoral system". *Revista Brasileira de Zootecnia, Viçosa* 32.6 (2003): 1845-1850.
11. Veiga JB., *et al*. "Silvopastoral systems in the eastern Amazon. In: Livestock Agroforestry Systems: Sustainability Optionsfor tropical and subtropical areas. Juiz de Fora: Embrapa dairy cattle; Brasília, DF: FAO (2001): 41-76.
12. Varella AC., *et al*. "Establishment of forage plants in forest-livestock integration systems in southern Brazil". In: Fontaneli RS; Santos HP dos; Fontaneli RS. Forage for crop-livestock-forest integration in the southern Brazilian region.-Bottom step: Embrapa Trigo (2009).

13. Paciullo DSC., *et al*. "Morphophysiology and nutritive value of brachiaria grass under natural shading and full sun". *Brazilian Agricultural Research* 42.4 (2007): 573-579.

14. Dias-Filho MB. "Silvopastoral systems in the recovery of degraded tropical pastures". In: Gonzaga Neto, S; Costa RG; PaschaL EC; Castro JMC. Symposium and Annual gathering of the Brazilian Zootechnics Society, 43. João Pessoa. Anais Joao Pessoa: SBZ: UFPB. Special supplement of the Brazilian Journal of Zootecnia 35 (2006): 535-553.

15. Silva RG. "Introduction to Animal bioclimatology". São Paulo: Editora Nobel (2000).

16. Junior G B., *et al*. "Beef cattle in the Cerrado: Hi-Stóricos and conjunctural aspects". In: Martha Junior, GB, L Sousa D M G (Edition.) Cerrado: Efficient use of corrective and fertilizer in pastures. 1 Edition. Brasília, DF: Embrapa technological Information (2007): 17-42.

17. Alves FV. "The animal component in integration production systems". In: Bungenstab, D.J. (Ed.) Integration Systems: Sustainable production. 2 edition Brasilia: Embrapa (2012) 143-154.

18. South Fame. "Silviculture brings environmental benefit first and economic for MS". Brazil: Agrolink, set (2012).

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