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RESEARCH ARTICLE

BIOTECHNOLOGY SOIL INERT RECOVERY EXTINCT EROSION AREA IN RESIDENTIAL GEOVANNI BRAGA AT THE ANNAPOLIS CITY IN THE STATE OF GOIÁS

[1]Welvis Furtado da Silva and [2,*]Ernane Rosa Martins

[1]Department of Environmental Engineering, Metropolitan College of AnápolisGoyaz, Anápolis, Brazil
[2]Coordination of Information Technology Area, Federal Institute of Education Science and Technology Goiaz, Luziânia, Brazil

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ABSTRACT

This article aims to present biotechnological methods used in the recovery of soil Inert in extinct erosion area in Residential Geovanni Braga, the Annapolis City Hall in the State of Goiás, through revegetation techniques with fertilization and planting forage braquiária to improve the bed of vegetable and microbiological soil structure and chemistry. The methodological procedures adopted understood literature review, to support the activities and field work, data collection, characterized as descriptive of the nature of the objective, as its main purpose to describe the recovery of degraded soil by erosion. The results obtained were surprising, showing no erosive focus and the visual impact of the site has been significantly improved, pleasing the neighboring population erosion. Running costs were lower than traditional techniques, showing that the techniques used were adequate, efficient and economical.

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INTRODUCTION

Erosions stand out as the major degrading soil processes, causing irreversible environmental damage, producing economic and social losses (Oliveira *et al*., 1990). Over time, large areas that were previously covered by native vegetation, were being destroyed by erosion. The problem is that human actions expose the soil rapidly compromising the whole (Venturoli *et al*., 2013) area. The gullies are a stronger type of erosion (Pereira *et al*., 2013), and the most advanced stage of erosion and thus more difficult to contain. Are products of surface waters, running on the surface, causing wear, landslides, hauls soil, may also be caused by deep water, infiltrating the soil, walk through into the profile, more or less vertically to find a waterproof layer or less permeable where they accumulate and moving horizontally, causing mudslides and landslides (Galeti, 1984).

Corresponding author: Ernane Rosa Martins,
Coordination of Information Technology Area, Federal Institute of Education Science and Technology Goiaz, Luziânia, Brazil.

To provide the reduction of rainwater speed at the head of gullies, terraces are built, which are a kind of channel (Filizola *et al*., 2011; Ismael *et al*., 2014). It is important to develop studies aimed at developing strategies aimed at controlling environmental degradation, as if no appropriate measures for the recovery of the degraded area is taken, the whole environment is put at risk, jeopardizing natural resources (Medeiros *et al*., 2014). Revegetation technique works on nutrient cycling in soil fertility and shadowing, improving ecological conditions and facilitating the development of species (Martins, 2009). Another technique is reforestation which works to reduce the impact of rain on the soil and provide nutrients for organisms present on site, favoring nitrogen fixation by legumes (Neto and Passini, 2014). Planting seedlings is important because after the first plants emerge, the soil is covered with litter and humus, which attracts animal dispersers of seeds and thus help in the recovery process of the degraded area. Based on the above, this article aims to present the practices used in Biotechnology Recovery Soil Inert in Extinct Erosion Area in Residential Geovanni Braga, the Annapolis City Hall in the State of Goiás, through techniques of revegetation with fertilization and planting forage braquiária to improve the bed of vegetable and microbiological soil structure and chemistry. This research is justified by the limited literature found on the recovery of degraded soil erosion and the techniques employed. The methodology comprised a literature review, to support the activities and field work for data collection. This article is divided into five sections, this section presents this addition to the introduction, the definition of the research problem, the goal, the rationale and importance of the study and the structure of this research. Section two (2) brings the theoretical framework, with the formation of a conceptual and theoretical basis, which provide support for the development of this study. In section three (3) presents the method employed and the technical and methodological procedures used for the study. In section four (4) shows the analysis and discussion of the results obtained in the research. Finally, in sectionfive (5) theconclusions.

LiteratureReview

The ecological restoration is a long time process, as there are species of native plants that take up 32 to be formed in the same way as the species present at the site before degradation (Alday *et al*., 2011). Bioremediation is a method which utilizes microorganisms present or inserted in place to perform the biochemical degradation of contaminants (Bernoth *et al*., 2000). The maintenance of soil fertility is key to the persistence of pastures. To restore soil fertility, it is often necessary to compensate for nutritional deficiencies, applying fertilizers (Pereira *et al*., 2013). The quality of the soil depends on the extent to which the soil is used for human benefit associated with the interventional practice man (Araújo *et al*., 2012). Revegetation is the ground cover in order to reduce the action of rain and wind prevent the development of erosive processes that favors particle entrainment and environmental degradation (Santos *et al*., 2011; Walnut *et al*., 2012). For ground cover can be used several species (Castro *et al*., 2011; Venturoli, 2011) such as: Amaranthuscruentus (amaranth), Avenastrigosa (oats), Cajanuscajan (pigeon pea-super and regular pigeon pea), ensiformesCanavalia (jack bean) coracanaEleusine (grass's foot chicken), Guizotiaabyssinica (niger), Hybiscuscannabinus (kenaf), Pennisetumglaucum (pearl millet), Raphanussativus (turnip), Sesamunindicus (sesame), Stizolobiumaterrimum (velvet bean) (Assis *et al*., 2005). The plants in the soil form a barrier, reducing the incidence of sunlight, moisture and increasing temperature.

Figure 1. Gully Geovane Braga

Figure 2. Collection of samples for physical and chemical analysis

Affecting the germination of seeds (Odenath *et al*., 2014). One method used to reduce excessive wind, protecting the area is the windbreaks technique that consists of planting trees and shrubs in rows to reduce excessive wind, reducing wind speed, minimizing the effects of this on the soil, protecting it from the wind erosion process, and reduce the incidence of sunlight that remove moisture from the soil (Collovini, 2013). No-tillage is a technique which consists of ground maintenance covered by vegetation in development and plant remains, aiming to protect it from the impact of rain, reducing the carrying of nutrients by leaching and erosion process (Cruz *et al*., 2006). For prevention and control of runoff and sediments, and for mi¬nimização the negative consequences caused by human intervention, can be implanted containment boxes to ensure stabilizing the processes from the production of sediment and recover degraded areas (Cunha *et al*., 2013).

Another technique for revegetation of the land is planted in contour lines, consisting of a more sustainable soil management, preventing erosion by planting vegetation following the curves of the land. (Farias *et al*., 2013) The contour lines are deployed from the marking points of the same height as the environmental level to be planted and the reverse direction of storm water runoff or irrigation. (Porto *et al*., 2012) It is essential for the development and implementation of land reclamation techniques, conduct research on the different environmental conditions, methods to recover each site to assess the ecosystem and ecological processes occurring in the environment (Ferreira *et al*., 2009). The degraded environments recovery techniques are the revegetation techniques, remediation and geotechnical techniques. Revegetation technique consists of planting located plant species that do not occur more or never occurred on site. Already remediation technologies are developed from methods of chemical or bioremediation treatments to neutralize or eliminate contaminants in soil and water. Geotechnical involve the construction of containment and retaining structures for the physical stability of the environment (Florentino, 2011; Santos *et al*., 2011). The remediation technique in restoring degraded environments is an attempt to reduce contamination levels as indicated human health and the environment (Tavares, 2013). It has also soil washing is carried out with the aid of surfactant solutions (Marques, 2012). And the bioremediation utilizing microorganisms present or inserted in place to perform the biochemical degradation of contaminants (Bernoth *et al*., 2000).

RESEARCHMETHODOLOGY

The work was carried out in the area that held the gully Geovane Braga which was located south of Annapolis in the eponymous district, part of the basin of the stream tributary Goes the right bank of the Antas River in Annapolis municipality in the state of Goiás. The emergence of erosion had a strong relationship with the launch to half hillside rainwater captured upstream. This release does not have the power dissipation of the flows of water that eroded easily little thick soil on very friable saprolite existing on site that also has steep slopes. Erosion had limitation in approximately 53 meters from the boundary with the street 04 to approximately 75 meters long, as shown in Figure 1. The methodological procedures adopted understood literature review, to support the activities and field work for data collection. This study was characterized as descriptive of the nature of the objective, as it has for the purpose to describe the recovery of degraded soil erosion in residential Geovane Braga in Annapolis in the state of Goiás (Gil, 1999).

Analysis and discussion of the results

The area was eroded isolated with wire fencing for animals, machines and people not operated on her or in neighboring areas (especially upstream). Agricultural activities in the surrounding area were interrupted by step degradation on site. firebreaks were built around the fences to protect the implanted vegetation of possible fires. The level of soil degradation was defined by determining the thickness of the surface horizon and for comparison with other soil profiles from nearby areas that have the same characteristics as assessed but which are still with vegetation. According to information contained in the IBGE Pedologia Technical Manual of the area degraded by erosion in question was in eroded phase, which has extremely strong erosion of class, ie, the soil is very deep grooves (gully) (IBGE, 2016). The area was divided into sub-areas with homogeneous characteristics, considering the natural drainage system, the stage of erosive processes, differences in color and texture of the soil, positioning relief, the vegetation in the area and history of use.

Figure 3. Tires used in the gully

After subdivision, soil samples from different subareas have been sent to physical-chemical analysis in the laboratory to evaluate the fertility of each and thus establish the best strategy for recovery as shown in Figure 2. For the analysis we used a sample of each area, made up of 10 to 20 single samples. Simple soil samples were taken at random, following a zigzag path, are taken by a cutting blade. The collected from each subarea material was thoroughly mixed in a bucket and then withdrew from 300 to 500g of land to form the composite sample that was sent to the laboratory for analysis. The collection depth was approximately 20 cm. Some erosion of the soil characteristics are described in Figure 3. To stabilize areas affected by voçorocamento process, it was decided to properly conduct the water from runoff in the area upstream, in order to reduce your speed and increase infiltration. This was due to the location of roads in inappropriate areas with bad drainage channels scaled without any drain. That the waters were diverted and escoassem orderly out of the eroded areas, have applied techniques of sunken terraces associated with vegetated channels spillways to retain water terraces lining used. The choice of the best technique to be used took into account local characteristics, soil type, land slope, machine availability and intensity of rainfall, among other factors. As it was not possible to forward or fully retain the waters escoriam into the gully, they used techniques that reduced its speed when scrolling through the inside, as the use of palisades. To reduce costs and present a larger diameter, the stanchions were made with shackles of water and sewage as shown in Figure 4. To prevent water open path beneath the palisades, causing his washouts, stones placed in the stockade and the bottom later into place to bamboo stakes vertically. Then tires are accommodated in the area available to absorb the impact of water crossing the palisade as shown in Figure 5. It is important to note that the use of these materials to stop water make a enculturation after stockade, compromising its structure. As the gullies occur parts with gullies and / or unstable slopes, it was necessary to carry out the recon formation to ensure its stability and allow the planting and establishment of vegetation as shown in Figure 6.

Figure 4. Palisade of water and sewage shackles installed in gullies

For this was used machines, because of the extent and the bank or slope height. This work was carried out during the dry season in order to have the entire area prepared to receive planting at the beginning of the rainy season. After performing the mechanical practices such as the construction of palisades and the reshaping of slopes and ravines, were applied plant remains for the formation of mulch on the surface eroded until the herbaceous species, shrubs and trees planted to establish and guarantee good protecting the soil.

Interessado: ELVIS FURTADO
Propriedade:
Remetente : IFB INSTITUTO DE FOSFATADOS BIOLOGICOS

Municipio : ANAPOLIS
Cultura....:
Material : Solo

UF.....: GO
Entrada: 11/01/2016
Emissao: 12/01/2016

Lab.	Amostra	Ca+Mg	Ca	Mg	Al	H+Al	K	K	P(Melich)	P(Resina)
		cmolc/dm3 (mE/100 ml)						mg/dm3 (ppm)		
016255	AM 01 00-40	3,8	3,3	0,5	0,0	1,0	0,12	45,0	11,6*	
016256	AM 02 00-20	3,5	3,0	0,5	0,0	1,0	0,11	43,0	11,2*	

Lab.	Amostra	S	Na	Co	Zn	B	Cu	Fe	Mn	Mo
		mg/dm3 (ppm)	micronutrientes mg/dm3 (ppm)							
016255	AM 01 00-40				18,7*					
016256	AM 02 00-20				16,7*					

Lab.	Amostra	CTC	Sat.Bases	Sat.Al	Ca/Mg	Ca/CTC	Mg/CTC	K/CTC	H+Al/CTC	Mat.Org.	Carbono
		Dados Complementares								g/dm3	
016255	AM 01 00-40	4,92	79,67%		6,60	67,07%	10,16%	2,44%	20,33%	8,0	4,64
016256	AM 02 00-20	4,61	78,31%		6,00	65,08%	10,85%	2,39%	21,69%	6,0	3,48

Lab.	Amostra	H2O	CaCl2	KCl	Argila	Limo	Areia
		pH			Textura (g/Kg)		
016255	AM 01 00-40		6,4		80,0	40,0	880,0
016256	AM 02 00-20		6,1		70,0	30,0	900,0

CRISTIANE RODRIGUES
Eng. Agronoma MSc
CREA-GO 8889/D

Figure 5. Results of the soil analysis

Table 1. Cultural Value Points amount, per hectare of each species, based on sowing conditions

VC NECESSARY QUANTITY FOR PLANTING 48400 m2 (ha)				
seeds	Ideal conditions	conditions Medium	Adverse conditions	planting depth
Brachiaria	350	450	550	1,0 a 2,0cm
Andropogon	350	450	550	0,5 a 1,0cm
Panicuns	300	350	400	0,5 a 1,0cm

Source: Description of packaging organophosphate

Table 2. Interpretation classes for active soil acidity

Chemistry classification						
acidity very high	Acidity high	Acidity average	Acidity weak	neutral	alkalinity weak	alkalinity high
> 4,5	4,5 - 5,0	5,1 - 6,0	6,1 - 6,9	7,0	7,1 - 7,8	>7,8

agronomic Rating				
Very low	Low	Good	High	Very high
< 4,5	4,5 - 5,4	5,5 - 6,0	6,1 - 7,0	> 7,0

Source:.ALVAREZ V.et al (1999) .pH in H2O, ratio 1: 2.5, Terra Fina Dry Air (TFSA): H2O

Figure 6. Reshaping the gully

For this, they used waste vegetable available in the region, preferring the more fibrous materials to cover the ground for longer, such as straw, bark, sawdust and all kinds of material available. Allied to this, the planting of herbaceous legumes and fast growing grasses gave protection to exposed soil in a short time, and improve the physical and chemical characteristics of the soil. They used species of legumes and grasses according to the climate. Throughout eroded area, low soil fertility predominated, and this feature has limited the establishment of plants. Thus, the use of the legume family of plants (Angico, Garapa, Pau Alligator, Vinhático, Dry flour etc.) was prioritized. This choice is justified by the symbiosis formation between their roots and bacteria (rhizobia) that fix atmospheric nitrogen and make available to plants and also with fungi (Mycorrhizae), which increase the absorption area of the roots, making the plant can better use soil nutrients. We recommend the use of mineral and organic fertilizer at the time of planting to ensure the establishment and development of the implanted vegetation. They used native species as part of the recovery plan, a lesser percentage, because they served to attract animal dispersers of seeds (birds and bats), which bring seeds of other species, enhancing biodiversity and contributing to the process of succession. The planting of these species was made with spacing of 2x2 meters to the vegetation recubra area as quickly as possible. The holes had dimensions of 30x30x30cm, and the planting was done in level, so that one is a line staggered from each other, forming a triangle between plants.

Figure 7. fertilizer and seeds used in planting

Figure 8. Difference in the plant receiving the phosphor. Source IFB (2016)

For the recovery of soil fertility were used organophosphate fertilizers, and implementation of Braquiária as vegetation cover, after the restoration of soil, degraded area. They were used for fertilizing the Ciclofértil compound as soil conditioner and fertilizer for organophosphate base fertilization on grass planting Braquiária, as shown in Figure 7. The seed to be used was BrachiariaBizantha (Brachiaria) with cultural value (CV) of 50% applied in the amount in Table 1 demonstrates. As White, Murgel and Cavinatto (2001) BrachiariaBizantha fertilized with organo phosphate present protein content 19,75% higher than plants fertilized with chemical and cost 40.2% lower. Microbial activity in the process of composting of municipal waste allowed solubilization of phosphate rock. The microorganisms involved in this activity are saprophytic bacteria and fungi by phosphorus deficiency, are able to solubilize insoluble phosphate forms, making the phosphorus available for bacterial growth and development of higher plants.

For the development of this saprophyte microflora is essential for the presence of organic matter as a source of carbon and energy. Forming an organo-phosphate fertilizer low cost, high efficiency and helps to solve the problem of organic waste present in erosion. In addition to effectively solubilize the capacity phosphorus, these also contribute to soil enrichment by nitrogen fixation (White *et al*., 2001). The fertilizer used showed similar or higher efficiency in terms of productivity, chemical fertilizers, and benefit significantly leaf composition especially regarding the levels of proteins important for the quality of forage grasses. The continuity of its application may result in a long-term increase in the content of humic substances of soil (White *et al*., 2001).

The match offered by common fertilizer dismissive, in time, with the plant's needs. This occurs because when the phosphorus is added to the soil it happens to react with the iron and aluminum present in this, again making it unavailable to the consumer of the plant. As it is made from organic substances, phosphorus contained in the organophosphate is more resistant to reaction with iron and aluminum. Not reacting, it is available for consumption of the plant for longer periods and are consistent with the plant needs, as demonstrated in Figure 8. As shown in the first graph of Figure 8, using common phosphorous fertilizer soon it becomes unavailable for the consumption of plants. When using the organ phosphorus IFB (second graph of Figure 8), being made from organic matter, it is available for longer, depending on the needs of plants.

The Cultural Value (VC) is an index that links two of the main seed quality parameters. physical purity percentage (P%) and its germination percentage (% L), and is calculated as follows:

$$\frac{(VC - P\%)xG\%}{100} \qquad (1)$$

Well, applying the formula to the minimum standards listed above, we would have a CV of 50% (P-84% x G-60%). The minimum standard for germination be 60%, most seeds out of the field with 80% to 85% germination. Assuming the G-80% value, which is the most used for marketing, we would have a CV of 48% (P-60 x G-80%). For the project we adopted G-84%.

Table 3. Soil fertility interpretation classes for. organic matter and the complex cation exchange

Feature	Unity 1	Classification				
		Verylow	Low	East2	Good	MuchGood
organic carbon (C.O.) 2	dag/kg	<0,41	0,41 - 1,16	1,17 - 2,32	2,33 - 4,06	> 4,06
Organicmatter(M.O.) 3	dag/kg	<0,71	0,71 - 2,00	2,01 - 4,00	4,01 - 7,00	> 7,00
calciumexchangeable(Ca2+) 4	cmolc/dm3	<0,41	0,41 -1,20	1,21 - 2,40	2,41 - 4,00	> 4,00
magnesiumexchangeable(Mg2+)4	cmolc/dm3	<0,16	0,16 - 0,45	0,46 - 0,90	0,91 - 1,50	> 1,50
acidityswitchable(Al3+) 4	cmolc/dm3	<0,21	0,21 - 0,50	0,51 - 1,00	1,01 - 2,0011	> 2,00 11
Sum of bases (SB) 5	cmolc/dm3	<0,61	0,61 - 1,80	1,81 - 3,60	3,61 - 6,00	> 6,00
Ac. Potential (H + Al) 6	cmolc/dm3	<1,01	1,01 - 2,50	2,51 - 5,00	5,01 - 9,0011	> 9,00 11
CTC effective (t) 7	cmolc/dm3	<0,81	0,81 - 2,30	2,31 - 4,60	4,61 - 8,00	> 8,00
CTC pH 7 (T) 8	cmolc/dm3	<1,61	1,61 - 4,30	4,31 - 8,60	8,61 - 15,00	> 15,00
saturation Al3+(m) 9	%	<15,1	15,1 - 30,0	30,1 - 50,0	50,1 - 75,011	> 75,0 11
saturation bases (V) 10	%	<20,1	20,1 - 40,0	40,1 - 60,0	60,1 - 80,0	> 80,0

Source: ALVAREZ V. et al. (1999)

For interpretation of this table, it is important to imply that:
1- dag / kg =% (m / m); c cmol / dm3;
2. The upper limit of this class indicates the critical level .;
3- Walkley& Black method; M.O. = 1,724 x C.O .;
Method 4 KCl 1 mol / L;
5- SB = Ca 2+ + Mg 2+ + Na + + K +;
6- H + Al, Ca method (OAc) 2 0.5 mol / l, pH 7;
7- t = SB + Al 3+;
8 T = SB + (H + Al);
9 m = 100 Al 3 + / t;
10- V SB = 100 / T;
11. The interpretation of these characteristics in these classes should be high and very high in good place and very good.

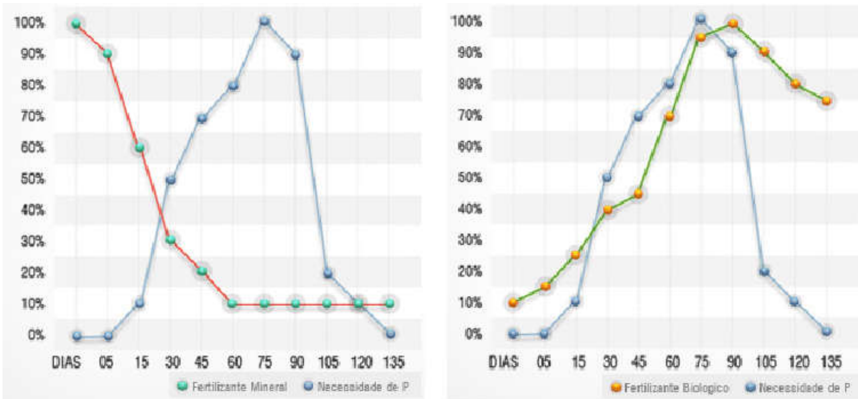

Figure 9. Root Growth with organophosphates. Source IFB (2016)

Table 4. Class interpretation of the availability for phosphorus according to the clay content or the remaining amount of phosphorus (P-REM) and potassium

Feature	Classification				
	Verylow	Low	Medium	Good	Verygood
	(mg/dm3)1				
Clay (%)	availablephosphorus(P)2				
60 - 100	<2,7	2,8 - 5,4	5,5 - 8,03	8,1 - 12,0	> 12,0
35 - 60	<4,1	4,1 - 8,0	8,1 - 12,0	12,1 - 18,0	> 18,0
15 - 35	<6,7	6,7 - 12,0	12,1 - 20,0	20,1 - 30,0	> 30,0
0 - 15	<10,1	10,1 - 20,0	20,1 - 30,0	30,1 - 45,0	> 45,0
P-rem4 (mg/L)					
0 - 4	<3,1	3,1 - 4,3	4,4 - 6,03	6,1 - 9,0	> 9,0
4 - 10	<4,1	4,1 - 6,0	6,1 - 8,3	8,4 - 12,5	> 12,5
10 - 19	<6,1	6,1 - 8,3	8,4 - 11,4	11,5 - 17,5	> 17,5
19 - 30	<8,1	8,1 - 11,4	11,5 - 15,8	15,9 - 24,0	> 24,0
30 - 44	<11,1	11,1 - 15,8	15,9 - 21,8	21,9 - 33,0	> 33,0
44 - 60	<15,1	15,1 - 21,8	21,9 - 30,0	30,1 - 45,0	> 45,0
potassiumavailable(K)2					
	<16	16 - 40	41 - 70	71 - 120	> 120

Source: ALVAREZ V. et al. (1999).
For interpretation of this table, it is important to imply that:
1 mg / dm 3 = ppm (w / v);
2 Mehlich-1 method;
3- In this class presents the critical levels according to the clay content or the value of the remaining match. The upper limit of this class indicates the critical level. P-rem = remaining match. phosphorus availability tracks will not be considered obtained by Resin, as there was no analysis by this method.

Table 5. Interpreting class availability for sulfur 1 according to the remaining amount of phosphorus (P-rem)

P-rem	Classification				
	Verylow	Low	East2	Good	Verygood
mg/L	(mg/dm3)3				
		sulfuravailable(S)			
0 - 4	<1,8	1,8 - 2,5	2,6 - 3,6	3,7 - 5,4	> 5,4
4 - 10	< 2,5	2,5 - 3,6	3,7 - 5,0	5,1 - 7,5	> 7,5
10 - 19	<3,4	3,4 - 5,0	5,1 - 6,9	7,0 - 10,3	> 10,3
19 - 30	<4,7	4,7 - 6,9	7,0 - 9,4	9,5 - 14,2	> 14,2
30 - 44	<6,5	6,5 - 9,4	9,5 - 13,0	13,1 - 19,6	> 19,6
44 - 60	8,9	9,0 - 13,0	13,1 - 18,0	18,1 - 27,0	> 27,0

Source: ALVAREZ V. et al. (1999).

For interpretation of this table, it is important to imply that:
1-extractor Ca (H2PO4) 2, 500 mg / L of P 2 in HOAcmol / L.
2-Thisclassindicatesthecriticallevelsaccordingtothevalueof P-rem.
3-mg / dm 3 = ppm (w / v).

Table 6. Classes of interpretation of availability for micronutrient

micronutrients	Classification				
	Verylow	Low	East1	Good	Verygood
mg/L	(mg/dm3)2				
Zn available (Zn) 3	<0,5	0,5 - 0,9	1,0 - 1,5	1,6 - 2,2	> 2,2
Mn available (Mn) 3	<3,0	3 - 5	6 - 8	9 - 12	> 12
Fe available (Fe) 3	<9,0	9 - 18	19 - 30	31 - 45	> 45
Cu available (Cu) 3	<0,4	0,4 - 0,7	0,8 - 1,2	1,3 - 1,8	> 1,8
B available (B) 4	<0,16	0,16 - 0,35	0,36 -0,6	0,61 - 0,9	> 0,90

Source: ALVAREZ V. et al. (1999).

For interpretation of this table, it is important that imply:
1-The upperlimitofthisclassindicatesthecriticallevel.
2-mg / dm 3 = ppm (w / v).
3-Mehlich-1 method.
4-Method hot water.

Table 7. Interpretation of P content classes in the soil suitable for grasses

texturalclassofsoil 1	phosphorusExtractor	phosphorus theory of clases soil		
		Low	Medium	High
		ppm		
loamy (36 a 60%)	Mehlich-1	< 6	6 a 10	> 10
Average (15 a 35%)	Mehlich-1	< 11	11 a 20	> 20
sandy (< 15%)	Mehlich-1	< 21	21 a 30	> 30
	Resina	< 16	16 a 40	> 40

Source: RABBIT & FRANCE (1995).

For interpretation of this table, it is important to imply that: 1 Percentage of clay.

Table 8. Examples of ionic effects inter

Íon	AccordingtoIonGift	According to the effect on the First
Cu	Ca	Antagonism
Mg, Ca	K	competitiveinhibition
H2PO4	Al	competitiveinhibition
K, Ca, Mg	Al	noncompetitiveinhibition
H2BO3	NO3, NH4	competitiveinhibition
K	Ca (high concentration)	competitiveinhibition
SO4	SO4	competitiveinhibition
SO4	Cl	competitiveinhibition
MoO4	SO4	competitiveinhibition
Zn	Mg	competitiveinhibition
Zn	H2BO3	competitiveinhibition
Fe	Mn	competitiveinhibition
Zn	H2PO4	noncompetitiveinhibition
K	Ca (lowconcentration)	synergism
MoO4	H2PO4	synergism
Cu	MoO4	noncompetitiveinhibition

Source: (Malavolta et al., 1997).

Table 9. Total budget

Product	R$ / kg e ton	ton / ha	Area (ha)	Kg e ton / ha	Total (R$)
CycleFertile	115,00 ton	10 ton / ha	2,5	25 ton / ha	2.875,00
bioactive	482,00 ton	1,2 ton / ha	2,5	3 ton / ha	1.446,00
brachiária	9,90 kg	11 kg / ha	2,5	27,5 kg	272,25
TOTAL					4.593,25

Source: Descriptionofpackagingorganophosphate

Figure 10. Area recovered from the gully

The recommended dose for planting Braquiária in the areas of conditions is:

$$Kg\ de\ semente/\ ha = \left(\frac{Pontos\ de\ Valor\ Cultural\ da\ espécie}{Valor\ Cultural}\right) = \frac{550}{11} = \frac{11Kg\ de\ semente}{ha} \qquad (2)$$

Fertilization was done with broadcast application 10 ton./ha of Ciclofértil compound for organic fertilizer and 1,200 kg / ha of fertilizer organofosofrado in basic fertilization, applied by throwing. The seed was applied manually broadcasted at a dose of 11 kg / ha. To facilitate distribution recommended to mix the seed with organophosphate. The phosphor provided by the time the plant needs, contributes to early root growth as shown in Figure 9.

The early root growth provides greater resistance and greater number of 'channels' food supply. Besides, it contributes to the environment, it reuses the manure produced by the area, avoiding waste and accumulation. Zinc deficiency is the most common to the development of grasses and more evident in cerrado soils. Some papers present approach of interpretation of this micronutrient. Thus, fertility classes is included for zinc, manganese, iron and copper, extracted with Mehlichextractant 1, and boron, extracted with hot water. The values found in soil analysis performed by the laboratory of SOLOCRIA Agricultural Laboratory Ltd. for Ca + Mg nutrients, Ca, MG, Al, H + Al, K cmolc / dm3 (mE / 100 ml) and P (Melich) mg / dm3 (ppm) Zn plus micronutrient in mg / dm3 (ppm) considering additional data for CTC Sat.BasesSat.Al Ca / mg Ca / mg CTC / CTC K / CTC H + Al / CTC and Mat.Org. Carbon g / dm3, justify the use of organophosphate fertilizer at planting planting forage Brachiaria, Poaceae family, Plantae kingdom and Eukaryota domain. To evaluate the potential hdrogênionico soil (pH) considered active characteristics of acidity (pH) over exchangeable aluminum, observing aluminum saturation and bases, the potential acidity and content of organic matter, which are related to each other. Also observed for soil acidity availability of calcium and magnesium, manganese, iron, copper and zinc described in Tables 2, 3 and 8

CORRÊA & HAAG (1993) cite several studies conducted to determine the requirements of P foragers who sought to relate soil characteristics as clay content, with the critical levels of P for forage plants. The results have not been satisfactory, making it difficult to extrapolate the results to other types of soils and, coupled with that fact, most studies of this nature was conducted in a greenhouse that according COPE & EVANS (1985), it has limited value as a basis to make fertilizer recommendations. Extrapolation of production data in the greenhouse is risky, because of the differences in the degree of exploitation of plant roots confined to the vessel and culture in the field. The levels of the nutrients on which plants respond, can be much higher when the greenhouse in field experiments (Correa, 1993; Cope, 1985). Plant roots are capable of absorbing phosphate solutions with very low concentrations of this compound (36). Generally the phosphate contents in the root cells and xylem is about 100 to 1000 times greater than that of the soil solution. This shows that phosphate is absorbed by plant cells against very large concentration gradient and hence absorption is active. The absorption of phosphate is considered as being made by means of H + cotransporter (Ulrich -Eberius 1981). In compliance with the soil analysis can be performed with the above comparative tables (Tables 2 to 8). Where the values of elements: Ca comes in doses 3.3 cmolc / dm3 with proper diagnosis, Mg 0.5 cmolc / dm3 with low diagnosis, 0.12 K in mg / dm3 with low diagnosis, Organic

Matter 80% high, Zn 1.7 in mg / dm3 high, pH 6.4 CaCl2 very high and 80% clay clayey.

CEC is the cation exchange capacity of the soil has. Tropical soils are less able to perform this exchange compared to temperate soils, organic matter decomposition is faster and the absorption of water by plants is higher in less CTC. The participation of nutrients analyzed in the soil of interest offering CTC pH 7.0 is: Ca 80%, H + 20.83% Al, K and Mg 0.01 10.42%. And the effective participation will be: Ca 86.84%, 13.86% Mg and K 0.01%. Noting the high content of organic matter in the soil and phosphorus percentage, accepted the fertilizer most suitable for the cultivation of grass for this soil being organofosfatada fertilization, for in every activity decomposing there is a CO2 production contributing to the enrichment of soil this compound. Undertheseconditions, thefollowingreactions are possible:

$$C_6H1_2O_6 + 6O_2 \text{ ———— } 6CO_2 + 6H_2O \quad (3)$$

That is, the resulting glucose metabolism decomposers beings combines with oxygen in aerobic respiration, forming carbon dioxide and water. This carbon dioxide combines the tricalcium phosphate, insoluble, forming di-calcium phosphate, by the reaction:

$$Ca_3(PO_4)_2 + CO2 + H_2O \text{—} Ca_2\ (HPO_4)_2 + CaCO_3 \quad (4)$$

Finally, dicalcium phosphate, in the presence of excess CO2 reacts with this forming dicalcium phosphate, soluble, through the reaction:

$$Ca_2(HPO_4)_2 + CO_2 + H_2O \text{ ——— } Ca\ (H_2PO_4)_2 + CaCO_3 \ (5)$$

These reactions do not occur under normal laboratory conditions, unless under very high temperature and pressure. In the presence of microorganisms they are made easily, using probably the energy obtained with the metabolization of organic matter. In this case, the solubilization of phosphates occurs regardless of the specific demand of phosphorus microorganisms involved and becomes proportional to the quantities of phosphate rock as well as, of course, the availability of organic matter to be degraded as a carbon and energy source. Regarding occurred expenditures was recorded that in the entire area recovery process these were 4593.25 (four thousand five hundred ninety-three reais and twenty-five cents) for the Ciclofértil products, Bioactive and seed brachiária as shown in Table 9.

Low maintenance was recorded in relation to replant and were not required new fertilizations in the recovered area. The results were evaluated three times: immediately after the execution of services in six and twelve months. In the evaluation performed shortly after the completion of work on the quality and safety of service performed, were not found weak points that could lead to new erosion gullies, with pleasant visual aspect, the evaluation of the locals was that there ever was human intervention in this local. In the evaluation carried out six months after fertilization and planting, Biological Sciences Specialist, Chemistry and Environment, Municipal Town of Annapolis found the full establishment of vegetation, as had already covered the whole area, as shown in Figure 10. In this evaluation had already been several heavy rains, and covering the entire area did not return any erosive focus and even carrying of sediment thus showing the efficiency of the techniques used.

Conclusion

This research aimed to present the practices used in land reclamation degraded by erosion in residential Geovane Braga in Annapolis in the state of Goiás, through techniques of revegetation with fertilization and planting forage braquiária to improve the vegetable bed and microbiological structure and soil chemistry. The Biological Phosphate Institute (IFB) has organophosphates fertilizers and compounds that restore the physical, chemical and microbiological soil by providing organic matter and nutrients, regaining fertility and promoting implementation of the vegetation cover. It follows that the application of degraded areas recovery processes and technologies provides environmental gains, such as: Minimization and / or eradication of the risk of accidents by hillside slides with the less well-off population invading these areas, the area of reuse, maintenance fauna and native flora, maintaining the quality of water bodies. It is worth noting, the gain in quality of life and the consequent rise of the region in environmental quality ranking, given that green areas, conservation areas and lower degradation rates are positive indicators that raise, in general, quality life and environmental health of a region. The techniques used and the results were surprising, showing no erosive focus Moreover, the visual impact of site was substantially improved. running costs were lower than traditional techniques, that is, it was found that the techniques used were adequate, efficient and economical. The results pleased the neighboring population to erosion by improving the visual did not show that there was human intervention there. With the use of bioengineering techniques no large movements of the earth, is used more biodegradable products occurring seepage water, the soil is fully protected conditions and offers the nature recomposition of the original vegetation in a shorter time period. To continue this research is suggested to carry out similar studies in other regions with erosions.

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