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# Adult Education and the Conservation of Soils and Water as Environmental Resources among Rural Farmers in Rivers State, Nigeria

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**ABSTRACT**

The study sought the roles of adult education in conservation of soil and water as environmental resources among rural farmers in Rivers State. The area covered by this study is the entire Rivers State. The target population of the study included all registered farmers and adult facilitators in Rivers State. This gave a total population size of 850. The sample size of the study was 570 respondents. The study adopted a self-constructed questionnaire developed by the researcher The instrument was rated on a five-point Likert scale of Strongly Agree (SA) - 5, Agree (A) - 4, Undecided (U) - 3, Disagree (D) - 2 and Strongly Disagree (SD)The instrument was subjected to face and content validity by threeexperts. The instrument has an internal consistency of 0.82 reliability index using Cronbach alpha reliability method. The findings of the study indicated adult education to a high extent influences the conservation of soil and water resources among farmers in Rivers State. Base on the findings of the study, the following recommendations were made Rural farmers should be educated on farming practices that encourages conservation of soil resources such as use of organic fertilizers, planting of cover crops, bush fallowing, tree planting and mixed cropping to facilitate the conservation process of this natural resources.Rural farmers should be educated on agricultural practices that will lead to the conservation of water as environmental resources, such as mulching to prevent water loss, adaptation to climate changes, control of water pollution through, inter alia, the establishment of effluent and water quality standards

**Keyword:**Adult Education, Conservation of Soil, Conservation of Water, Environmental Resources,Rural Farmers

## Introduction

Nigeria agriculture is basically rainfed, characterized by low productivity and subjected to the vagaries of weather. Water is therefore a limiting factor to agricultural production in most parts of the country. According to Sjögren (2015), there are several reasons why water and not land may become the most important constraint for Nigeria's food security. Water is an important constituent of the geo system; it is the most abundant substance on earth. It exists in a variety of forms such as sea water, snow, surface water, soil moisture, groundwater and water vapour. In addition, water is particularly important to life; the earliest string of life on earth started in water and even though some forms have strayed away from their natural habitat to be sustained on land water is still considered for their survival. Man can live several weeks without food, but without water, the longest he can live is ten days (Nyawade, 2015). However, water is not only for sustenance of life, but is also essential for socioeconomic development. Agriculture, the first step in enabling the development of societies, requires vast amount of water. In a single growing season, a plant may absorb as much as 2000 times its grain yield (Nyawade, Karanja, Gachene, Schulte-Geldermann& Parker, 2018a).

Crops can be grown without fertilizers, but they cannot survive without water and soil. Without adequate moisture, plants cannot mobilize soil nutrients. Lack of water at critical stages of development will result in stunted plant growth. The demand for higher crop yields is greatest in many countries where water is increasingly scarce, either due to low annual rainfall or to concentrated periods of precipitation with long intervening dry spells. To meet future food needs, farmers will have to make better use of all available moisture by employing water harvesting, conservation and efficient irrigation methods (Nyawade, Karanja, Gachene, Schulte-Geldermann& Parker,2018b).

Globally, agriculture consumes more than two-thirds of the water withdrawn from the earth's rivers, lakes and aquifers but, in low-income countries, agricultural water use is some 90% of the whole. Agriculture is not only the world's largest water user in terms of volume, it is also a relatively low-value, low-efficient and highly subsidized water user. In contrast, poor families in some large cities are forced to spend up to 20% of their income on

water (Otieno, Chemining'wa&Zingore, 2018). If there is to be enough water for all, on a sustainable basis and if depleted groundwater resources are to be restored, it follows that agriculture, the prime consumer, must take prime responsibility for more efficient use. Yet, farmers are being asked to produce more food on soils which are already overworked and degraded and where water may become the limiting resource. It seems that farmers are constantly being asked to achieve more with less. So how can this dilemma be resolved? Equitable access will have to be achieved by policy-makers instituting measures to control demand by engineers using technology to increase efficiency of supply and delivery systems and by users who will have to guard against a profligate waste of a precious resource to avoid soil erosion.

In order to have a clue to soil erosion control, it is necessary to understand the causes of soil erosion. The main cause is the misuse of agricultural land by man. However, the fundamental cause of soil erosion is economic. Principally related to this is the high pressure on land due to a dense and expanding population often characteristic of developing nations. The people endeavor to make a living by clearing the forest; by cultivating lands on steep slopes; by adopting faulty methods of cultivation that neither conserves water nor soil; by felling trees for fuel power and shelter and letting their animals loose for grazing until all vegetative cover has been so reduced that it no longer offers protection to the soil (Baccini, Walker, Carvalho, Farina, Sulla-Menashe & Houghton, 2017). Other causes of soil erosion outside the influence of man are natural factors. These include high rainfall amount and intensity, nature (texture) of the soil and the topography of the land. Thus, the primary activities that can initiate accelerated erosion are: deforestation, intensification of agricultural land use and cropping practices, over grazing by animals and construction activities, for example roads, culverts, etc.

Dwindling arable land frontier and population pressure in most developing countries where the need for poverty alleviation is critical have forced the poor farmers to practice both intensification and extensification. The intensification if not properly planned and executed could exacerbate the erosion problem. The limited available arable land has made shifting cultivation a thing of the past. In this circumstance, the same piece of land is tilled every year. With the fragmentation of land by families, the land witnesses each succeeding year with more pressure, resulting in the extension of cropping onto marginal lands. The soil needs to be conserved because it is the material medium for plant growth. On these soils depend agriculture and related primary production activities. It comprises of mineral and organic matter. Nature takes between 300 - 1000 years to build 2.5 cm of soil (Batary, Andras, Kleijn, &Tscharntke, 2011), while a very intensive rainfall event can result in the loss of tonnes of soil. This makes soil resources a subject of importance in the drive towards natural resources conservation in the country. Efficient and profitable crop production hinges upon achieving a conducive soil environment capable of retaining adequate soil nutrient and moisture for sustained seed development and growth. It is therefore not an overstatement to say that because of the role the soil plays in sustaining plant and animal life, our very existence depends on the conservation of this all-important natural resource base.

Nigeria has a wide diversity of soils under different ecological conditions and with different levels of fertility. The traditional land tenure system and soils management practices involving shifting cultivation, slash-and-burn processes and traditional tillage method ensure the maintenance of soil physical properties and the sustainability of productivity. However, land use pressure has reduced the duration of fallow to restore soil fertility below the recommended minimum threshold required for sustainability (FAO, 1985). In an attempt to remedy the situation the following strategies have been put in place: Conservation farming, also referred to as permanent agriculture, involves the proper use of every parcel of land (especially soil) for good sound agriculture with a view to enhancing the future (Belay, 2014). This is through wise use of the natural environment, which includes protection of nature, controlled production of useful materials as well as control or elimination of environmental pollution. Several methods have been recommended to farmers for the conservation of their soils. These include the planting of vetiver grass to reduce erosion, zero tillage and minimum tillage. Farmers in their effort to make their farmlands continue to sustain their activities have adopted conservation methods that are not labour-intensive, highly cost effective, compatible with the existing farming system, cheap and easy to install and maintain. These practices which include mulching, cover cropping and contour tillage are considered as sustainable soil Conservation practices.

Many indigenous conservation methods such as ridging, terracing, multiple cropping and fallowing were used in the pre-colonial era (Bisina, 2006). In the colonial times, the British Government conducted largescale projects on soil conservation, but many failed as imported technologies were inadequate. Soil fertility issues gained more emphasis after independence. Decreasing funds at the end of the oil boom in the 1980s however restricted soil conservation schemes (Bisong& Andrew-Essien, 2010). Agroforestry, or alley farming, is another alternative strategy to the slash-and-burn system. It is an erosion control technology that involves the cultivation of annual crops within hedgerows formed by leguminous trees and shrubs such as acacia. These legumes help in nitrogen fixation, enhance nutrient cycling through their deep roots, provide biomass for use as mulch and fodder for livestock, as well as improve soil organic matter and sustain crop yield under continuous cropping. It was introduced in Nigeria in 1980, initially to the south east and later to the south west (Bosah, 2013). Field trials show that trees improve the soil structure and maintain a high infiltration rate which reduces runoff. Reasons adduced for adoption and continued usage include soil fertility improvement, production of staking material and poles, fuel wood, reduction of fallow length, feed for animals and erosion control.

The use of cover crops improves soil structure, increases nitrogen level, and acts as weed smothers. Examples of cover crops include Pueraria and Mucuna. They can be planted in pure stands on an uncultivated piece of degraded land or in association as a relay with an annual crop such as maize. Brodie (2018) cited additional advantages of Mucuna to include increased crop yield, the ability to suppress weeds such as spear grass (*Imperatacylindrical*), thus reducing the arduous task of weeding, provide livestock feed and income for adopters through the sale of seeds. Application of domestic wastes (including animal waste) is an age-long traditional practice on farmlands. It is a source of nutrient as well as an ameliorative material for degraded soils. Results from a study using animal wastes as soil amendments (Chacon, 2012) showed a reduction in soil strength

parameters like compaction and bulk density, arising from the increased pore spaces and enhanced infiltration capacity which ultimately minimized runoff and soil erosion. Multiple cropping, a traditional practice very common in Nigeria, also reduces erosion, improves soil properties and decreases the risk of total crop failure. However, reduced crop yield may arise when crops are combined with trees possibly because of competition for sunlight, water and nutrients. Minimum tillage or zero tillage is an appropriate soil conservation technology in Nigeria as it reduces erodibility (Chan & Sasaki, 2014). This form of conservation tillage results in long-term maintenance of the soil structure and an increase in water retention and hydraulic conductivity. Zero-tillage practice is however not applicable to stem tubers and root crops which are usually planted on ridges.

It is therefore to be noted that land cannot be restored in any significant quantity without the involvement of farmers. So there is the need to train and motivate farmers in this regard. Conservation techniques are needed which are simple, efficient and relatively cheap. Above all, there is the need for more emphasis on better land husbandry through which the restoration process is linked to improved plant productivity. For example, composting and manuring increase soil nutrient levels and lead to better soil structure, making the system more productive and more resilient to erosion. Agroforestry methods, such as barrier hedges of nitrogen-fixing leguminous species, may have an important role to play. Grass strips are another alternative to earth bunds in areas where there is enough rainfall to support them. This can only be achieved through adult education.

## Statement of the Problem

Generally, the purpose of adult education centers on improving quality of the environment through the efforts of individuals, groups and society at large. It aims at liberating adults and by extension young children from the shackles of ignorance, poverty, and poor health resulting from environmental degradation. It focuses on how to develop enquiring minds and creative thinking in adults on how to produce more in our farms and factories without disrupting environmental equilibrium. It is needed to develop in adults, an ethical awareness of all forms of life with which humans share this planet, respect all life cycles and impose limits on human exploitation of other forms of life. Adult needs to be informed of their lifestyles that are not environment friendly. For adults to be committed to the principles of environmental management, they need to be sensitized or enlightened. This is the focal point of adult education.

However, ignorance, greediness poverty, extravagance and carefree attitude are some of the factors that promote environmental - incompatible life styles among Nigerians. Individually, many people are wasteful in the use of resources. Deforestation is a big and serious problem. Fuel wood gathering, clearing of large area for ranching, commercial logging for tropical hardwood and bush burning are some other ways by which adults tamper with ecological balance. Some of these activities are avoidable or better still can be unified with the environment.

Most of our agricultural practices in Nigeria are not environment- friendly. Uncontrolled use of pesticides and fertilizers destroy the environment. A state of overfishing now exists in our rivers, creeks and lakes. Because of the pathetic state of the situation, fishermen now use fishing nets with smaller net mesh sizes and other destructive techniques like the use of chemical to catch fish. Soper (1998) stated that heavy fishing produces a population of many young small individuals because fish are caught as soon as they reach a catch able size. Many of the tiny fish ought to have been left to grow in size, but for economic situation. Hunters are not known for selective hunting in Nigeria. They kill any animal that comes their ways no matter how small or rare. These actions are leading to the loss of biodiversity.

**Purpose of the Study**

Generally, the purpose of the study was to investigate into the Roles of Adult Education on the Conservation of Soil and Water as Environmental Resources among Rural Farmers in Rivers State. Specifically, the study was planned to:

1. Determine the roles of Adult Education inthe Conservation of Soil as Environmental Resources among Rural Farmers in Rivers State.
2. Examine the roles of Adult Education in the Conservation of Water as Environmental Resources among Rural Farmers in Rivers State.

**Research Questions**

Two research questions guided the study

1. What are the roles of Adult Education inthe Conservation of Soil as Environmental Resources among Rural Farmers in Rivers State.
2. What are the roles of Adult Education in the Conservation of Water as Environmental Resources among Rural Farmers in Rivers State.

**Hypotheses**

Two hypotheses were formulated for the study

$Ho_1$There is no significant difference between the mean responses of adult facilitator and farmers on the roles of Adult Education on the Conservation of Soil as Environmental Resources Among Rural Farmers in Rivers State.

Ho2There is no significant difference between the mean responses of adult facilitator and farmers on the roles of Adult Education on the conservation of water as environmental resources among rural farmers in rivers state.

## Methodology

Descriptive survey design was adopted in this study. The area covered by this study is the entire Rivers State. The target population of the study included all registered farmers and adult facilitators in Rivers State. This gave a total population size of 850 which include 680 registered farmers (source: Corporate Affair Unit, Rivers State) and 170 adult facilitators (ADP, ARAC, 2020). The sample size of the study was 570 respondents. The state was clustered into three senatorial districts (Rivers East, Rivers South-East and Rivers West). Five Local Government Areas were purposively selected from each cluster to obtain fifteen (15) Local Government Areas for the study. Three farmers' cooperatives society were purposively selected,

furthermore, all the 8 executives, two ex-officio members and 20 randomly selected members were added to give 30 farmers from each local government areas. A minimum of 40 adult facilitators were then randomly selected from each of the three zone in Rivers State. This gave a total sample size of 570 respondents which comprise of 450 registered farmers and 120 adult facilitators. Uzoagulu (2011) explained that simple random sampling technique is used to give equal chances of being selected in a population.

The instrument used for this study was a self-constructed questionnaire titled "Adult Education in Conservation of soil and water Resources Questionnaire" developed by the researcher on the role of adult education in conservation of soil and water resources among rural farmers. The instrument contains five sections A-E. The instrument was rated on a five-point Likert scale of Strongly Agree (SA) - 5, Agree (A) - 4, Undecided (U) - 3, Disagree (D) - 2 and Strongly Disagree (SD) - 1.

The instrument was subjected to face and content validity by threeexperts in Adult Education and Community Development Department in Rivers State University. The instrument has an internal consistency of 0.82 reliability index using Cronbach alpha reliability method. The instrument was administered to the farmers and Adult Education Facilitators by the researcher and with the help of three research assistants. The research questions were answered using mean and standard deviation and the null hypotheses were tested at 0.05 level of significance using t-test. Items in the research questions with mean response of 3.5 and above were regarded as agreed while those below 3.5 were regarded as disagreed. The null hypotheses were accepted if the calculated value of t (t-cal) was less than the table or critical value (t-crit) and rejected when the calculated value of t (t-cal) was greater than the table or critical value (t-crit).

**Research Questions**

Research Question 1: What are the roles of Adult Education onthe Conservation of Soil as Environmental Resources among Rural Farmers in Rivers State?

**Table 1: Mean of Roles of Adult Education in Conservation of Soil Resources**

| | | **Farmers** | | | **Adult Facilitators** | | |
|---|---|---|---|---|---|---|---|
| **S/NO** | **Adult Education taught us the following:** | $\bar{x}$ | **SD** | **RMK** | $\bar{x}$ | **SD** | **RMK** |
| 1 | Effective crop rotation to integrate strategies for the conservation and sustainable management of soil | 4.59 | .622 | A | 4.64 | .490 | A |
| 2 | adopt soil cover for the conservation and improvement of the soil, | 4.27 | .758 | A | 4.08 | 1.038 | A |
| 3 | combat its erosion and misuse as well as the deterioration of its physical, chemical and biological or economic properties | 4.16 | .713 | A | 3.96 | 1.020 | A |
| 4 | Educate farmers in the use of mulching, minimum tillage or zero tillage to conserve soil resources | 4.09 | .960 | A | 4.04 | .889 | A |
| 5 | Educate farmers in the use of biological conserve soil resources | 4.18 | .922 | A | 4.16 | .943 | A |
| 6 | Educate farmers in the use of organic fertilizers to conserve soil resources | 4.16 | .888 | A | 4.16 | .746 | A |
| 7 | Educate farmers in planting of cover crops to conserve soil resources | 4.30 | .978 | A | 4.08 | .997 | A |
| 8 | Educate farmers in the use of bush fallowing to conserve soil resources | 4.05 | .939 | A | 3.96 | 1.020 | A |
| 9 | Educate farmers in the use of shifting cultivation to conserve soil resources | 4.41 | .726 | A | 4.00 | .957 | A |
| 10 | Educate farmers in the use of tree planting to prevent erosion and conserve soil resources. | 4.00 | .915 | A | 3.92 | 1.152 | A |
| 11 | Educate farmers in implementing Mixed Cropping as a method of soil conservation | 4.00 | .988 | A | 4.44 | .651 | A |
| | **Grand Mean** | **4.20** | **0.86** | **A** | **4.13** | **0.90** | **A** |

Data in Table 1 showed that farmers had a mean range of 4.00-4.50 and standard deviation range of 0.62-0.98 while the adult facilitators had a mean range of 3.92-4.64 and standard deviation range of 0.49-1.15. This indicates that they agreed that adult education has a role in conservation of soil resources among farmers in Rivers State. The closeness of the standard deviations showed the homogeneity of the respondents

**Research Question 2:**What are the roles of Adult Education on the Conservation of Water as Environmental Resources Among Rural Farmers in Rivers State?

**Table 2: Mean of Roles of Adult Education in Conservation of Water Resources**

| | | Farmers | | | Adult facilitators | | |
|---|---|---|---|---|---|---|---|
| **S/NO** | **Adult Education taught us the following:** | $\bar{x}$ | **SD** | **RMK** | $\bar{x}$ | **SD** | **RMK** |
| 1 | Educate farmers to the use of planting of cover crops and crop rotation to conserve water resources | 4.27 | .845 | A | 3.92 | 1.077 | A |
| 2 | Educate farmers to the use of fertilizers, pesticides, herbicides and inorganic fertilizers application to conserve water resources | 4.20 | .851 | A | 4.20 | .913 | A |
| 3 | Educate farmers to the use of mulching to prevent water loss and conserve water resources | 4.36 | .892 | A | 4.00 | 1.080 | A |
| 4 | Educate farmers to the use of irrigation systems for conservation of water resources . | 3.93 | .998 | A | 4.24 | .970 | A |
| 5 | Educate farmers to use protection of forests, wetlands, and natural ecosystems to ensure of conservation of water. | 4.14 | 1.153 | A | 4.12 | 1.054 | A |
| 6 | Educate farmers to adaptation to climate changes to ensure conservation of water resources. | 4.16 | 1.140 | A | 3.92 | 1.038 | A |
| 7 | Educate farmers to manage their water resources so as to maintain them at the highest possible quantitative and qualitative levels | 4.14 | .979 | A | 4.32 | .690 | A |
| 8 | Educate farmers to prevent damage that could affect human health or natural water resource in another State by the discharge of pollutants | 3.98 | .927 | A | 4.00 | .957 | A |
| 9 | Educate farmers to prevent excessive abstraction, to the benefit of downstream communities | 4.14 | .930 | A | 3.72 | .980 | A |
| 10 | Educate farmers to the use of crop rotation to conserve water resources | 3.93 | 1.043 | A | 3.96 | 1.136 | A |
| 11 | Educate farmers to study of water cycles and the investigation of each catchment area | 4.09 | 1.053 | A | 3.96 | .889 | A |
| 12 | Educate farmers to take inventory and management of all water resources | 4.32 | .959 | A | 3.88 | 1.130 | A |
| 13 | Educate farmers on the control of water pollution through, inter alia, the establishment of effluent and water quality standards | 3.91 | 1.117 | A | 3.96 | .978 | A |
| | **Grand Mean** | **4.129** | **0.99** | **A** | **4.015** | **0.99** | A |

Data in Table 2 showed that farmers had a mean range of 3.93-4.36 and standard deviation range of 0.84-1.15 while the adult facilitators had a mean range of 3.92-4.32 and standard deviation range of 0.69-1.13. This indicates that they agreed that adult education has a role in conservation of water resources among farmers in Rivers State. The closeness of the standard deviations showed the homogeneity of the respondents.

**Hypotheses**

**$HO_1$**: There is no significant difference between the mean responses of adult facilitator and farmers on the roles of Adult Education on the Conservation of Soil as Environmental Resources Among Rural Farmers in Rivers State.

**Table 3: t-test analysis on the roles of Adult Education in Conservation of Soil as an Environmental Resource**

| **Respondents** | **N** | **Mean** | **Std. Deviation** | **d.f** | **p-value** | **t-cal** | **t-crit** | **RMK** |
|---|---|---|---|---|---|---|---|---|
| Farmers | 425 | 4.129 | 0.99 | 538 | 0.05 | 1.32 | 1.96 | Accepted |
| Adult facilitators | 115 | 4.015 | 0.99 | | | | | |

Table 3 showed that t-cal at (1.32) is less than t-crit at (1.96) which indicated that the stated null hypothesis was accepted thus there is no significant difference between the mean responses of adult facilitator and farmers on the roles of Adult Education on the Conservation of Soil as Environmental Resources among Rural Farmers in Rivers State.

$HO_2$ There is no significant difference between the mean responses of adult facilitator and farmers on the roles of Adult Education on the Conservation of Water as Environmental Resources among Rural Farmers in Rivers State.

**Table 4: t-test analysis on the roles Adult Education in Conservation of Soil as an Environmental Resource**

| Respondents | N | Mean | Std. Deviation | d.f | p-value | t-cal | t-crit | RMK |
|---|---|---|---|---|---|---|---|---|
| Farmers | 425 | 4.20 | 0.86 | | | | | |
| | | | | 538 | 0.05 | 1.25 | 1.96 | Accepted |
| Adult facilitators | 115 | 4.13 | 0.90 | | | | | |

Table 4 showed that t-cal at (1.25) is less than t-crit at (1.96) which indicated that the stated null hypothesis was accepted thus there is no significant difference between the mean responses of adult facilitator and farmers on the roles of Adult Education on the Conservation of Water as Environmental Resources among Rural Farmers in Rivers State.

## Discussion of Findings

The findings of the study indicated adult education has roles in the conservation of soil resources among farmers in Rivers State. The findings of the study is in line with Agwu, Anyanwu, Uduogu and Akinnagbe (2008) who explained that Soil degradation is increasingly regarded as a major constraint to food production in tropical environments of the world. These problems are primarily caused by soil erosion, which is particularly damaging the soil surfaces in the tropics (Lal 1987; 1995). The detachment of soil particles from the landmass and the transportation of the loosened material to another place are termed soil erosion. As Agwu, Egbule, Amadu, Morlai, Wollor and Cegbe, (2011) observed, soil is a limited and an irreplaceable resource, and continues to face threats from erosion, which poses a great danger to agricultural production.

The findings of the study indicated adult education has roles in the conservation of water resources among farmers in Rivers State. The findings of the study is in line with Akanni (2013) who explained that Water scarcity is one of the most important problems that threaten environmental sustainability. Water scarcity refers to a condition characterized by insufficient water resources to satisfy the average, long-term total demand requirements by all sectors, including the environment (Akunyili, 2003). It should be noted that water is of importance and great value because of its impact on ecological functions, programs of socio-economic development, cultural and religious values, natural beauty as well as the worldwide limited water resources. However, water demands in some developed and developing countries have grown to the extents that are beyond the power and capacity of water supply providers (Andel, 2006).

## Conclusion

The findings of the study showed that adult education has roles in the conservation of soil and water as environmental resources among rural farmers in Rivers State. Therefore, overcoming these environmental challenges requires the need to learn and practice the skills, and the development of conscious attitude and responsible behaviors of preserving, protecting, and restoring environmental quality which promote sustainable development. This necessitated the need for environmental education that will enable the rural farmers to appreciate the environment through its preservation and sustainability in Nigeria.

**Recommendations**

Base on the findings of study, the following recommendations were made:

1. Rural farmers should be educated on farming practices that encourages conservation of soil resources such as use of organic fertilizers, planting of cover crops, bush fallowing, tree planting and mixed cropping to facilitate the conservation process of this natural resources.

2. Rural farmers should be educated on agricultural practices that will lead to the conservation of water as environmental resources, such as mulching to prevent water loss, adaptation to climate changes, control of water pollution through, inter alia, the establishment of effluent and water quality standards

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