

# GLOBAL JOURNAL

OF SCIENCE FRONTIER RESEARCH: D

## Agriculture & Veterinary

Stimulating Plant Growth

Mechanical Control of Rodents

Highlights

Participatory Evaluation of Oat

Assessment of Quantitative Variation

Discovering Thoughts, Inventing Future

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## Laser Radiation as a Method of Stimulating Plant Growth

By Sevostyanova N N, Trezorova O Y, Danilovskikh M G, Zhukova M Y  
& Likhanova I A

*Novgorod State University*

**Annotation-** Crop production is one of the dynamically developing branches of agriculture. The main directions of the industry's development are not only to increase crop yields but also to obtain environmentally friendly products. The work presents the rationale for the use of laser light to activate the growth of plants. The example of Savoy cabbage shows the positive effect of using a semiconductor laser with a wavelength of 650 nm, radiation power of 150 MW, and a radiation duration of 30 seconds. It shows not only the increase of leaf area by 67% and the head weight by more than 15% but also the accumulation of proteins and carbohydrates by an average of 15% in the plant samples of the experimental group. All this indicates an increase in the energy of plant growth. The proposed technology makes it possible to increase the yield of crop production with minimal usage of fertilizers and chemical protection products.

**Keywords:** *coherent radiation, laser radiation, photonics, photoperiodism, crop production, horticulture, plant growth stimulation.*

**GJSFR-D Classification:** *FOR Code: 070199*



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# Laser Radiation as a Method of Stimulating Plant Growth

Sevostyanova N N <sup>α</sup>, Trezorova O Y <sup>σ</sup>, Danilovskikh M G <sup>ρ</sup>, Zhukova M Y <sup>ω</sup> & Likhanova I A <sup>¥</sup>

**Annotation-** Crop production is one of the dynamically developing branches of agriculture. The main directions of the industry's development are not only to increase crop yields but also to obtain environmentally friendly products. The work presents the rationale for the use of laser light to activate the growth of plants. The example of Savoy cabbage shows the positive effect of using a semiconductor laser with a wavelength of 650 nm, radiation power of 150 MW, and a radiation duration of 30 seconds. It shows not only the increase of leaf area by 67% and the head weight by more than 15% but also the accumulation of proteins and carbohydrates by an average of 15% in the plant samples of the experimental group. All this indicates an increase in the energy of plant growth. The proposed technology makes it possible to increase the yield of crop production with minimal usage of fertilizers and chemical protection products.

**Keywords:** coherent radiation, laser radiation, photonics, photoperiodism, crop production, horticulture, plant growth stimulation.

## 1. INTRODUCTION

The development of crop production, as a branch of agriculture, determines the socio-economic development of regions not only in Russia but also in the world. Every year in our country, there is an increase in acreage by 6.5 %. This indicator is provided due to the expansion of the area of industrial and grain crops while reducing potatoes and vegetables.

However, the data on the yield of these crops indicate its growth, which is the result of several factors, including the active application of fertilizers (organic and mineral) by agricultural producers and the use of various chemicals to stimulate growth and increase the resistance of crops to diseases and control them. Every year, the production of pesticides and herbicides in our country rises by 6-8%, which negatively affects the ecological state of the environment and the quality of produced products (according to the Russian Union of Manufacturers of Chemical Plant Protection Products). The negative impact of chemicals affects the entire

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biosphere, shifting the balance towards the resistance of pathogens to pesticides themselves and reducing the immune response of plant organisms. High toxicity also affects the genetic apparatus of cells, leading to the development of irreversible negative consequences. Also xenobiotics are accumulated in the body, which leads to the poisoning of animals and humans. Over the past eight years, the total consumption of pesticides in Russia has increased more than 208 times and amounted to 156.6 thousand tons. That is why, since 2017, our country has been implementing a scientific and technical program for the development of agriculture, which involves the transition to the production of environmentally friendly agricultural products by 2025 through the development and introduction of new highly efficient and safe technologies.

In practice, physical methods of exposure, which differ from chemical ones in environmental friendliness, safety, and low energy consumption, have shown high efficiency. There has been proven high efficiency of coherent radiation, which has a stimulating effect on plants, activating the genetic potential through switching photosynthetic systems without changing the DNA structure [1].

Light has a regulatory effect on photosynthetic plants, being a source of energy. The method of laser stimulation affects photosynthesis, that is, the formation of organic matter under the influence of light. If in the dark phase (at night) vegetative plants are illuminated with red light (that is, light energy) of a given wavelength, this will enable the inclusion of FS-II (photosystem-II), which triggers the cascade mechanism of energy synthesis in the form of ATP macromolecules and the hydrogen donor in anabolic reactions - the NADP H<sub>2</sub> coenzyme. After removing the light exposure, FS-II will turn off. Then FS-I (photosystem I) activates enzymatic systems through a higher action potential of phytochrome and phytohormone with the help of additionally generated energy of ATP and the reducing agent NADP H<sub>2</sub>. This accelerates the synthesis of protein and carbohydrates, increasing yield.

If we talk about the influence of light on various stages of plant development, then the effectiveness of coherent radiation in pre-sowing seed treatment has been proven. If we expose the light of the red spectrum, the seed germination rate, vigor, stress resistance, health status, and survival rate of plants, as well as the

yield and quality of the crop, increase. All of these made it possible to introduce laser technologies in agriculture, which allow achieving high results by activating the genetic potential of the plant organism and reducing the use of chemical stimulants and pesticides.

It is worth noting that the laser systems developed and used in agriculture are far from perfect due to low productivity and large overall dimensions [2,3].

## II. EXPERIMENTAL PART

Devices with helium-neon lasers are the most common laser installations in agriculture. In the Krasnodar Territory of Russia, Kazakhstan, and Ukraine, were used installations that were mounted on self-propelled agricultural machinery for processing vegetative plants or installed in storage facilities for pre-sowing seed treatment. Devices had a significant weight, about 16 kg. The operator chose power and duration of processing for each crop, and controlled it from the vehicle cab. Because the treatment was carried out in the dark, there were often plants traumatization and dark pauses for those areas that were at a great distance from the device.

Since the beginning of the 2000s, Danilovskikh M G conducted the research on the effect of laser radiation on the growth and development of plants. He tested the optomechanical on various crops. The peculiarity of the device was a semiconductor laser, which differs from its analogs in its small size and energy consumption. Long-term experiments allowed us to choose the optimal radiation dose for crops and start field tests.

For the research, we selected a vegetable crop – planted seedlings of Savoy cabbage of the "Salima F1" variety of early maturation. This variety of cabbage has a raised rosette of leaves. The leaf is transversely-broadly

elliptical, strongly bubbly, medium-sized, covered with a waxy coating. The color varies from green to dark green. The head is oval or round, yellowish on the cut. The outer and inner stumps are short. The weight of the head is 1.8-2 kg.

Workers of KFKH D. P. Pavlyuk (village Ermolino, Novgorod region, North-West of Russia) conducted the planting in early June. The average daily temperature at the time of planting was in the range of +17...+19C, at night + 11C. This temperature regime is optimal since cabbage is hard to tolerate hot, dry air.

The treatment was carried out by an optomechanical laser beam control device twice – one day after planting the seedlings in the open ground and 12 days later (June 5 and 17, 2019). The treatment was carried out with a red-band semiconductor laser with a radiation wavelength of 650 nm and radiation power of 150 MW for 30 seconds.

The growth energy of Savoy cabbage was calculated from the growth rate and the area of the leaf plate since the leaf plate displays photosynthetic activity. On June 8, 15 and 24, 2019, the leaf plate was measured, and the cabbage samples were photofixed (Picture 1).

After treatments, the leaf surface area was measured according to the standard method:

$$S=0.75 \times a \times b,$$

where a is the length of the leaf, cm;

b – width at the widest part of the leaf, cm.

The leaf plate, being the main assimilating organ of plants, accumulates synthesized organic substances that serve as structural and energy material for the entire plant organism. The area of a single leaf and the total leaf surface of the plant allow us to assess the photosynthetic potential and intensity of its work.



Picture 1: Photofixation of Savoy cabbage (irradiated plants are on the left, control group plants are on the right).

The workers carried out harvesting on 07.07.2019 while we measured and recorded the weight, size of the heads, and their biochemical composition.

## III. RESULTS AND DISCUSSIONS

The assessment of the growth energy of Savoy cabbage by the change in the area of the leaf plate (Table 1) has shown that, on average, the leaf surface

area of Savoy cabbage in the control group is 220.7 cm<sup>2</sup> larger than the leaf area of the control samples (we carried out measurements on June 8). As a rule, the first leaves unfold slowly, but already at the first measurement, there is a significant difference. Further, the growth accelerates, facilitated by optimal climatic conditions - the air temperature was 18-26 C. On June 15, we also noted the trend of more active development of irradiated plants. Namely, the area of cabbage leaves in the experimental group was 723.4 cm<sup>2</sup> more than the

area of leaves in the control samples. At the time of photofixation of the plantings, we noted the earlier formation of heads in the plants of the experimental group (see Picture 1, photo is on the right). Measurements from June 24 showed us an increase in the area of the leaf plate by 937.9 cm<sup>2</sup> in the experimental group. The acceleration of the leaves' growth composing the head affects the size of the head, increasing it in size.

*Table 1:* Effect of laser treatment on the leaf surface area of Savoy cabbage

Average leaf area of one plant, cm <sup>2</sup>					
June 8		June 15		June 24	
control group	experimental group	control group	experimental group	control group	experimental group
403,9±3,8	624,6±4,0	818,4±4,2	1541,8±4,9	1407,0±4,8	2344,9±5,7

We connect such a high growth rate of the leaf plate with the activation of biochemical processes after laser stimulation. The intracellular components absorb light, which leads to a change in the thermodynamic equilibrium. Short-term heating leads to a change in the physical and chemical properties of chromophores and their surrounding areas, which activates the adenylate cyclase signal transmission system inside the cell. An increase in the number of protein macromolecules leads to the activation of biochemical processes, as a result of which the redox potential of mitochondria grows. Then activation of ATP synthesis starts, which is also spent on protein synthesis, increasing the growth energy [4,5].

After harvesting, we selected groups of heads of the control and experimental groups to assess the size and weight of the heads. A cabbage head is a group of twisted leaves that grow from an apical bud. The yield of cabbage and the heads' size directly depend on the number of healthy leaves in the rosette and their size.

The studies have shown that on average the girth of a cabbage head is 7.4 cm larger, and the weight is 1.1 kg heavier in the experimental group samples compared to the control ones. (Table 2).

*Table 2:* Measurement of Savoy cabbage heads

№	Measurement parameter	Measurement object	
		Control group	Experimental group
1	Average girth of a cabbage head, cm	41,9±0,11	49,3±0,12
2	Average weight of a cabbage head, kg	1,9±0,27	3,0±0,30

We carried out biochemical analysis on June 9, stored the crop in a refrigerated room at a temperature of +3 C and air humidity of 85-90%. Then, we extracted the selected samples, determined the content of free sugars (glucose) and proteins in the solutions by a photo-electrocolorimeter, determined the quantitative fat content by the extraction-weight method. (Table 3).

The average glucose content was 0.4 g / 100g higher in the samples of the experimental group. Even at low concentrations, glucose has a significant protective effect, lowering the freezing point. We noted a rise in glucose content by 15.19% in the experimental group, which indicates an increase in the frost resistance of cabbage, and its energy value.

Most of the organic nitrogenous substances of plants are proteins. In plants, there are quantitatively fewer protein substances than carbohydrates, but they play a significant role in the construction of living matter and the implementation of life processes. All processes of plant growth and development are connected with them. When using laser radiation, plants accumulate 15.14% more protein, which is an indicator of the activation of several growth, shaping, physiological and biochemical processes. It reflects the active growth of the leaf area and the weight of the head.

Fats (lipids) are an essential component of living cells, providing selective permeability and liquid-crystal properties, although most plants accumulate

relatively few lipids (about 2%). Also, lipids are protective substances that help a plant tolerate adverse effects of the external environment. The fat content in the experimental group was increased by 14.66% and

amounted to 0.13 g/100 g. Cabbage has a low-fat content, which does not affect organoleptic parameters, but affects the resistance of plants to low temperatures.

*Table 3:* Average glucose, protein, and fat content in Savoy cabbage samples

№	Measurement criterion, g/100 g	Measurement object	
		Control group	Experimental group
1	Glucose content	2,85±0,06	3,29±0,04
2	Protein content	1,14±0,02	1,32±0,02
3	Fat content	0,11±0,005	0,13±0,002

#### IV. CONCLUSIONS

In vivo treatment of Savoy cabbage of Salima F1 variety with short-term exposure to coherent radiation rises the functional activity of plant organisms, activating cell division. We can see it in an increase of leaf area, earlier maturation, and accumulation of a larger amount of dry matter. The use of stimulating plant growth on non-polluted with chemicals land allows us to obtain higher-quality, environmentally safe agricultural products.

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# Mechanical Control of Rodents by Using Wire-Box and Glue Traps in Sugar Cane Plantations at Sohag Governorate, Egypt

By Abd El-Aleem S. S. Desoky, Abdel - Latief A. Abazaid & Mahmoud M. K. Ali

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**Abstract-** These studies were carried out during two successive years (2017-2019) at Sohag Governorate (Gazert Shandweel Village Located at 15 km North of Sohag District). In this study, wire-box and glue traps were used to control rodents attacking Sugar cane plants. The results showed that the number of rodents caught during the 2017-2018 season was 45 individuals using wire-box traps and 73 individuals by glue traps, and the results in the second year 2018-2019 show that the number of rodents caught by wire-box traps was 65 individuals. and 78 individuals with glue traps. Both data in Table (1,2) showed that the glue traps were the highest rodent species captured from the thicker traps and most suitable for the house mouse, *M. musculus*.

**Keywords:** wire-box traps, glue traps, rodents, sugar cane, *m. Musculus*.

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# Mechanical Control of Rodents by using Wire-Box and Glue Traps in Sugar Cane Plantations at Sohag Governorate, Egypt

Abd El-Aleem S. S. Desoky <sup>α</sup>, Abdel - Latief A. Abazaid <sup>ο</sup> & Mahmoud M. K. Ali <sup>ρ</sup>

**Abstract-** These studies were carried out during two successive years (2017-2019) at Sohag Governorate (Gazert Shandweel Village Located at 15 km North of Sohag District). In this study, wire-box and glue traps were used to control rodents attacking Sugar cane plants. The results showed that the number of rodents caught during the 2017-2018 season was 45 individuals using wire-box traps and 73 individuals by glue traps, and the results in the second year 2018-2019 show that the number of rodents caught by wire-box traps was 65 individuals. and 78 individuals with glue traps. Both data in Table (1,2) showed that the glue traps were the highest rodent species captured from the thicker traps and most suitable for the house mouse, *M. musculus*.

**Keywords:** wire-box traps, glue traps, rodents, sugar cane, *m. Musculus*.

## I. INTRODUCTION

Rodents attack sugar cane and sugar beet from the beginning of planting until harvest, which leads to a decrease in juice quality, sucrose percentage and productivity per feddan (feddan = 1.038 acres). As well as the productivity of sugar per feddan in all growing seasons. The annual loss in sugar cane crop caused by *A. niloticus* was estimated by 5-8% in weight. The proportions of rat damaged mill able stalk averaged 23.99% and of dead stalks (due to damage) 7.17% in non-baited fields while in baited fields, rat damaged mill able stalks averaged 13.53 % and of dead stalks 3.85% (Porguez & Barredo, 1978). Rodent damage to sugar cane in Upper Egypt was estimated by 20 to 40 % reduction in yield, and 30 % in final sucrose in the infested stalks of sugar cane (Abazaid, 1990).

Rat trapping may be an effective rodent management tool for the following reasons: It is mainly necessary to identify, survey and control pest species. Locking up rodent pests is often better than using poisons. Traps prevent rodents from dying in hard-to-reach places and causing an odor problem. There is no chance of accidental or secondary poisoning of non-target animals. Traps can be used in situations where poison are not permitted or recommended. Very useful for managing the residual pests that live after the

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poisonous taste. *Tripathy et al., (2017)*. This study aims at a comparative study of mechanical control by using wire-box and glue traps in sugar cane plantations.

## II. MATERIALS AND METHODS

These studies were carried out during (2017-2018) (2018-2019) at Sohag Governorate (Gazert Shandweel Village Located at 15 km .North of Sohag District) Two feddans were chosen randomly cultivated with sugar cane (30) traps ( 15 Wire traps – 15 glue traps) were baited with bread and set up in 10 rows every month at 6 pm and examined each morning for three successive nights were baited with bread and set up in 10 rows every month at 6 pm and examined each morning for three successive nights. Trapped rodents were transferred to the laboratory for identified according to *Osborn and Helmy (1980)* Records were made for the date and number of individuals collected from each rodent species The percentage of each species was determine.

## III. RESULTS AND DISCUSSION

Evaluation of the efficacy of two rodent traps (wier traps-glue traps) for rodent control. This method is safe to environmental without pollution and not costly and higher than for reduce rodent population density. *Frantz and Padula(1983)* proved an laboratory study addressing the mode of action of glue entrapment on lab mice, and the behavior of confined lab mice around glue traps. Their results are important in that they provide insight into The interaction between mice and glue Traps, A discussion of the materials used as sticky adhesives for rodent and bird glue traps and repellents is provided by *Fitzwater(1982)*. *Corrigan(1994)* stated that many factors are likely to affect the efficacy and repellency of glue traps against rodents within real world biological and men- biological factors.

Data in table (1) and figure (1)show the caught number of the different species of the field rodent in winter, Spring, Summer and Autumn in Sohag Governorate, through 2017- 2018 for wire-box traps were (7-9-13 and 19 individual) respectively with total 45 individual on other hand the caught number of the different species of for glue traps were (14-17-22 and 20 individual) respectively with total 73 individual.

Table (1): Total numbers of rodent species captured per season when used wire-box and glue traps under field conditions during 2017/2018

Season	Month	Wire- traps				Glue- traps			
		I	II	III	Total	I	II	III	Total
Winter	December	1	1	0	2	1	4	0	5
	January.	1	1	0	2	0	4	0	4
	February	1	2	0	3	2	3	0	5
Total		3	4	0	7	3	11	0	14
Spring	March	2	1	0	3	2	4	0	6
	April	2	2	0	4	1	4	0	5
	May	1	1	0	2	1	4	1	6
Total		5	4	0	9	4	12	1	17
Summer	June	3	1	0	4	2	5	1	8
	July	2	3	0	5	2	5	0	7
	August	2	1	1	4	2	5	0	7
Total		7	5	1	13	6	15	1	22
Autumn	September	2	3	0	5	2	5	0	7
	October	3	2	1	6	1	6	0	7
	November	3	2	0	5	1	5	0	6
Total		8	7	1	16	4	16	0	20
Overall total		23	20	2	45	17	54	2	73
Percentage		51.11	44.44	4.04		23.29	73.97	2.79	

Signs: I =A. niloticus

II =M. musculus

III= R.r.frugivorus

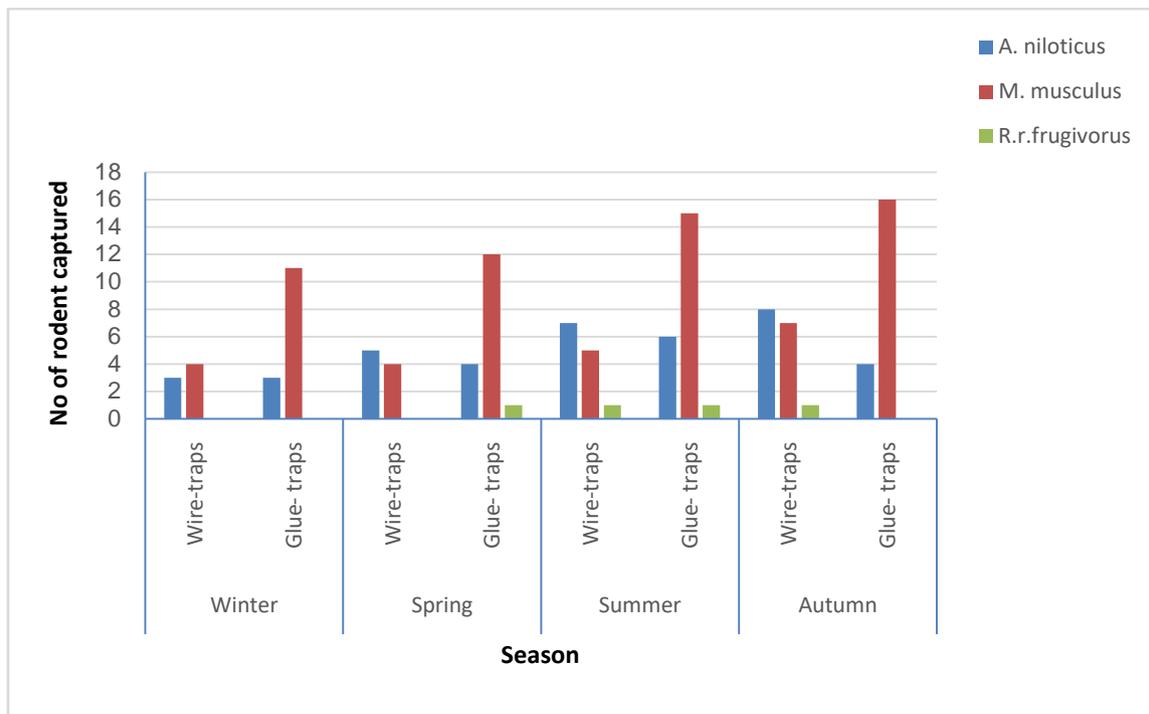


Figure (1): Total numbers of rodent species captured per season when used wire-box and glue traps under field conditions during 2017/2018

Data in table (2), figure (2) and photo (1) show the caught number of the different species in Winter, Spring, Summer and Autumn through 2018- 2019 for wire-box traps were (10 - 18 - 19 and 18 individual) respectively with total 65 individual. In the cause of the glue traps caught number of the different species were (15- 18- 24 and 21 individual) respectively with total 78 individual. Both data in table (1,2 ) proved that the glue traps were the higher of rodent species captured than wire-box traps and most suitable for house mouse, *M. musculus* L. A discussion of the material used as sticky adhesives for rodent and bird glue traps and repellents is provided by *Fitzwater (1982)*. *Corrigan ( 1988)* stated that it is not Known whether or not pheromones play a negative (or positive) role in The interaction and repeated captures of mice on glue traps. However

negative impact does not, seen as likely at least with juvenile captures ,as when multiple captures occurred, the capture was often entirely made up of juveniles *Corrigan (1994)* stated that many factors are likely to affect the efficacy and repellency of glue traps against rodents within real world biological and non- biological factors.- *Desoky (2013)* found that mechanical control methods achieved great success in rodent control as compared chemical control. The percent of reduce in with rodent active burrows population by using mechanical Control methods ranged between 93-20 % in deep irrigation, 87.20 % in handing destroy and 52-60% in trap methods, This method is safe to the environment with not costly and higher than for reduce rodent population density.

**Table (2):** Total numbers of rodent species captured per season when used wire-box and glue traps under field conditions during 2018/2019.

Season	Month	Wire- traps				Glue- traps			
		I	II	III	Total	I	II	III	Total
Winter	December	2	1	0	3	2	3	0	5
	January.	2	0	0	2	0	4	0	4
	February	4	1	0	5	1	4	1	6
Total		8	2	0	10	3	11	1	15
Spring	March	4	1	0	5	2	2	0	4
	April	4	1	1	6	1	4	1	6
	May	3	3	1	7	2	6	0	8
Total		11	5	2	18	5	12	1	18
Summer	June	4	1	0	5	3	5	0	8
	July	4	1	1	6	3	4	1	8
	August	4	3	1	8	3	5	0	8
Total		12	5	2	19	9	14	1	24
Autumn	September	4	2	0	6	2	5	0	7
	October	3	2	0	5	1	5	0	6
	November	4	2	1	7	2	6	0	8
Total		11	6	1	18	5	16	0	21
Overall total		42	18	5	65	22	53	3	78
Percentage		64.62	27.07	7.07		28.23	67.95	3.85	

Signs.: I =*A. niloticus*  
 II =*M. musculus*  
 III= *R.r.frugivorus*



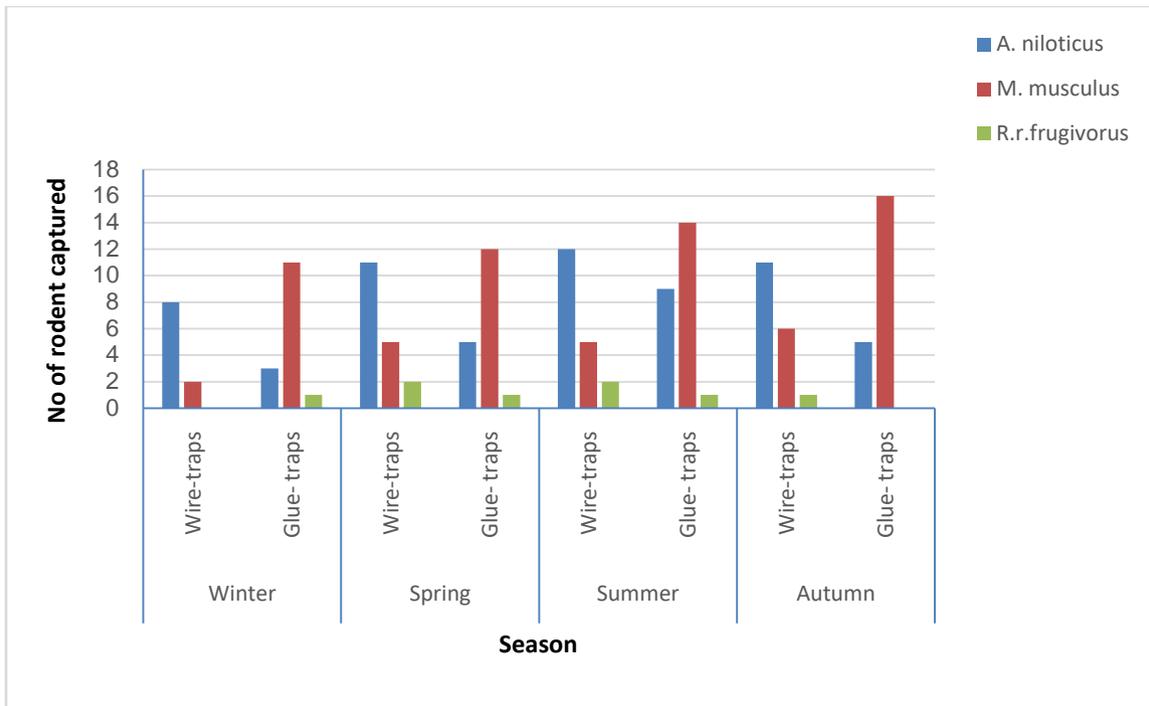


Figure (2): Total numbers of rodent species captured per season when used wire-box and glue traps under field conditions during 2018/2019



Generally: glue traps are preferred to control the small size and age of rodents that attack sugar cane crops.

*Photo(1):* Wire-box and glue traps used in the current study

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# Assessment of Quantitative Variation of Rajma Bean Genotypes for Yield and Yield Attributing Traits in Multi-Environments of Nepal

By Rajendra Darai, Padam P. Poudel, Rabendra Sah, Jang B. Sah, Binod Gupta, Santosh Rasaili & Rajesh Sharma

**Abstract-** Rajma (*Phaseolus vulgaris* L) known as the common bean, French bean, kidney bean, bush bean, and pole bean is the most important grain legume of Nepal which covers about 10,529 ha areas along with the productivity of 1477 kg/ha. Generally it is grown during summer in mid/high hills and during winter (post rainy) season in terai/inner terai in rice and maize based eco-system. Now Rajma bean is being popular as the cash crop in the province 3, 5 and 6 because of producing organic products and tastier quality. Multi-environment trials was carried out at Nepalgunj, Parwanipur, Itahari and Surkhet during the winter season of 2014-2017 comprised of 10 diverse Rajma genotypes in Randomized Complete Block Design with three replications in order to evaluate the quantitative variation with respect to yield and yield contributing traits.

**Keywords:** component traits, environments rajma bean, quantitative, variation.

**GJSFR-D Classification:** FOR Code: 070199



ASSESSMENT OF QUANTITATIVE VARIATION OF RAJMA BEAN GENOTYPES FOR YIELD AND YIELD ATTRIBUTING TRAITS IN MULTI ENVIRONMENTS OF NEPAL

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RESEARCH | DIVERSITY | ETHICS

# Assessment of Quantitative Variation of Rajma Bean Genotypes for Yield and Yield Attributing Traits in Multi-Environments of Nepal

Rajendra Darai <sup>α</sup>, Padam P. Poudel <sup>σ</sup>, Rabendra Sah <sup>ρ</sup>, Jang B. Sah <sup>ω</sup>, Binod Gupta <sup>¥</sup>, Santosh Rasaili <sup>§</sup> & Rajesh Sharma <sup>x</sup>

**Abstract-** Rajma (*Phaseolus vulgaris* L) known as the common bean, French bean, kidney bean, bush bean, and pole bean is the most important grain legume of Nepal which covers about 10,529 ha areas along with the productivity of 1477 kg/ha-1. Generally it is grown during summer in mid/high hills and during winter (post rainy) season in terai/inner terai in rice and maize based eco-system. Now Rajma bean is being popular as the cash crop in the province 3, 5 and 6 because of producing organic products and tastier quality. Multi-environment trials was carried out at Nepalgunj, Parwanipur, Itahari and Surkhet during the winter season of 2014-2017 comprised of 10 diverse Rajma genotypes in Randomized Complete Block Design with three replications in order to evaluate the quantitative variation with respect to yield and yield contributing traits. The combined analysis of variance showed that the highly significant differences among the genotypes and locations in the traits like days to flowering, days to maturity, plant height, hundred seed weight and grain yield. However; there was not any GxE interaction effect found in days to flowering, days to maturity and grain yield. Mean yield performances showed that the genotype PDR-14 (2341 kg ha-1) produced the highest yield followed by Utkarsh (2332 kg ha-1) and Arun-2(2021 kg ha-1). In conclusion, PDR-14 gave 9-56% higher yield among the genotypes and its stability analysis test also indicated that PDR-14 was found a highly stable across the environments and over the years. Variegated red kidney shape seed, white flowers along with dwarf and glabrous leaf pubescence is the DUS trait of the PDR-14 and recommended for terai/inner terai to high hills.

**Keywords:** component traits, environments rajma bean, quantitative, variation.

## I. INTRODUCTION

Rajma is an important legume known as Common bean, French bean, Kidney bean, bush bean, and pole bean. In many developing countries, common bean (*Phaseolus vulgaris* L.) are being grown for vegetables and pulses in diverse cropping system. The common bean is a self-pollinated species belonging to the Fabaceae family and is the most

important sources of the protein (Broughton et al. 2003). A high number of small land holding farmers with low incomes usually adopted to produce the crop. In Nepal, it is cultivated an areas of about 10,529 ha with the productivity 1477 kg/ha and being popular as the cash crop in the Gandaki province, province 5 and Karnali province. It grows as a summer crop in mid/high hills & winter crop in terai/inner terai. The high genetic diversity found in African, Asian and European germplasm has suggested the possibility that those continents could be considered as other centers of genetic diversity for common bean (Ocampo et al. 2005; and Sharma et al. 2014). It is an important legume crop cultivated in a wide range of agro-climatic conditions from Tarai (91m amsl) to high hill (2500m amsl) of Nepal, especially in mountain districts such as Jumla, Humla, Mustang, Rasuwa, Solukhumbu, etc, where mixed landraces with varying morphologies are cultivated. Nepal's hills and mountains are rich in bean diversity, and some landraces have unique characteristics (KC et al 2016, Joshi et al 2017a). In general, common beans grown in high-hill have better taste and are considered more nutritious compared to the beans grown in Terai region of Nepal. More recently, this crop is commonly grown along with kidney bean, fetches good return and have well established market (Neupane et al 2008, Muchui et al 2008, Shrestha et al 2011, Neupane and Vaidya 2002). In these days, area of phaseols bean is in increasing trends due to its good market potential along with good returns. This bean is being popular in Jumla and periphery districts of Karnali province known as Jumla's organic bean gift(Jumla ko Kosheli) in the Nepalgunj and Kathmadu big marts. The main objective of the study was in order to evaluate the quantitative variation with respect to yield and yield contributing traits. In terai region of Nepal, Rajma has been cultivating in winter season. Till date, there is not anyone Rajma variety released/registered for the farmers cultivation. One of the mandated organizations for legumes research, GLRP, Khajura has prepared the variety development program in collaboration with NARC satellite stations.

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## II. MATERIALS AND METHODS

In Coordinated Varietal Trial (CVT); A total of 10 genotypes namely PDR-14, Amber, Utkarsha, Arun-2, BL-63, Kanpur, Chitra NL-1, Pant-1 and Pant-2 were evaluated in 2015 at RARS, Parwanipur and GLRP, Khajura, in 2016 at JRP, Ithari; GLRP, Khajura; ARS, Surkhet and RARS, Parwanipur, same as in 2017 at GLRP, Khajura. Trial was conducted in Randomized Completely Block Design in  $4 \times 3.6 = 14.4$  m<sup>2</sup> plot size with three replications. The plant geometry, row-to-row space was maintained as 40 cm and plant to plant 10 cm. Recommended dose of fertilizer 100:60:40 kg NPK/ha was applied, full dose of phosphorus and potash and half dose of nitrogen applied during field preparation and remaining half dose of nitrogen was top dressed after 20-30 days after sowing. During the intervention period, precision agronomic packages were followed and appropriate pesticides and insecticides were applied as per the requirements. Data on agromorphological traits, yield and yield components were collected and data was analyzed using META-R and R-Stat Version 3.2.

## III. RESULTS

At Parwanipur, 2015, the results of analysis of variance showed statistically highly significant differences among the genotypes in the agronomic traits days to 50% flowering, days to maturity, plant height, grain yield and 100 seed weight. Genotypes Arun 2(11500 kg/ha) and Utkars (1079 kg/ha) were produced better yield among the tested genotypes in Table 1. Likely in khajura, the results of analysis of variance (Table 2) revealed that genotypes were statistically significant differences in the parameters like plant height, seed per pod and hundred seed weight. Genotype NL1 (563 kg/ha), and Arun-2(542 kg/ha) were produced the highest yield among tested genotypes. NL-1 had a bolder seed (38 g/100 seed). In 2016, at GLRP, Khajura data (Table 3) revealed that the genotypes were highly significant in days to maturity, plant height, and seed weight. Genotype Utkarsh produced the highest yield (2600 kg/ha) followed by, PDR-14 (2471 kg/ha) and Pant-1 (1983 kg/ha). Arun-2 showed the highest seed weight (47 g/100 seed). Same as in 2016, JRP, Ithari data showed that the genotypes were highly significant in days to 50% flowering, days to maturity and plant height and significant in grain yield. Genotype Utkarsh produced the highest yield (1625 kg/ha) followed by, PDR-14 (1412 kg/ha) in Table 4. Data (Table 5) illustrated that genotypes were statistically significant difference in the parameters like days to maturity, plant height, and hundred seed weight. Genotype Amber (3146 kg/ha) produced the highest yield followed by Arun-2(3090 kg/ha) and Utkarsh (2986 kg/ha). Arun-2 had a bolder seed (44 g/100 seed). In

2016, RARS, Parwanipur data analysis of variance showed that the genotypes were highly significant difference in days to flowering, days to maturity, plant height, grain yield and seed weight. Genotype Utkarsh produced the highest yield (1538 kg/ha) followed by, PDR-14 (1369 kg/ha) and Amber (1256 kg/ha). Same as previous Arun-2 had the highest seed weight (52 g/100 seed) in Table 6. Likely in the year of 2017, GLRP, Khajura data analysis of variance revealed that the genotypes were significantly difference (<0.005) in days to 50% flowering, days to maturity, plant height, seed per pod and yield kg/ha. Genotype PDR-14 produced the highest yield (2319 kg/ha) followed by, Utkarsh (1992 kg/ha) and BL-63 (1878 kg/ha) in Table 7. Combined mean analysis of variance showed that genotypes were significantly different in days to maturity, plant height and yield parameters across the locations over the years (2015-2017).

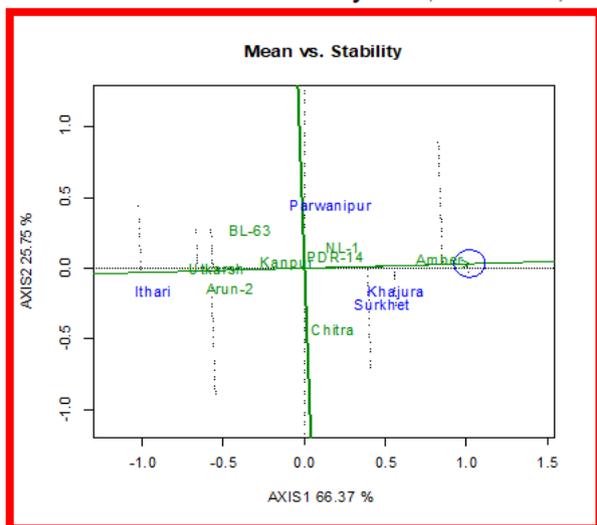


Fig. 1: Genotypes mean vs. stability

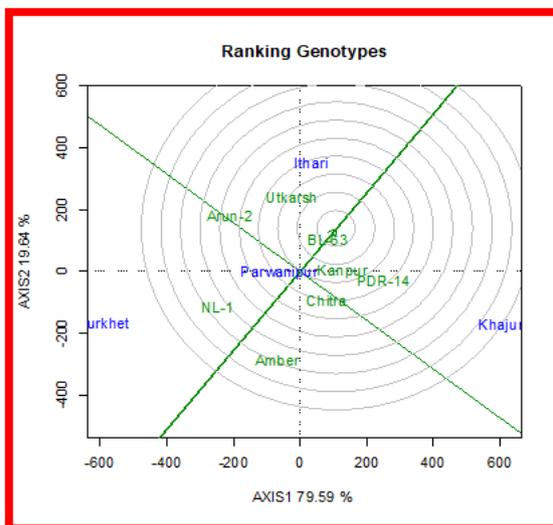


Fig. 2: Ranking of genotypes based on genotype performance and stability

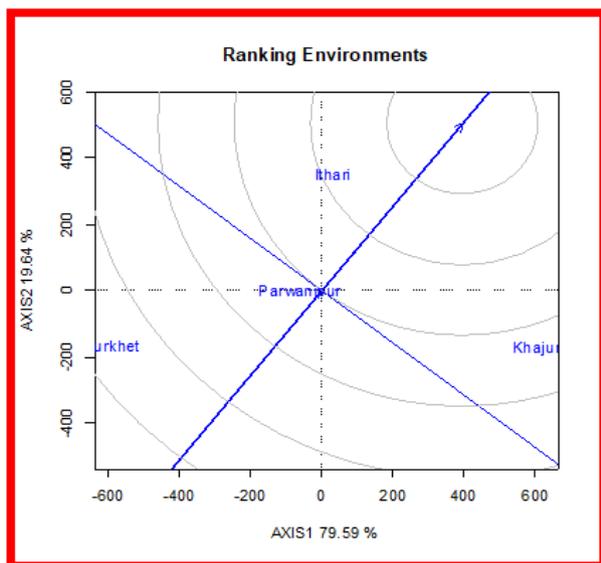


Fig. 3: Ranking of genotypes based on discriminating

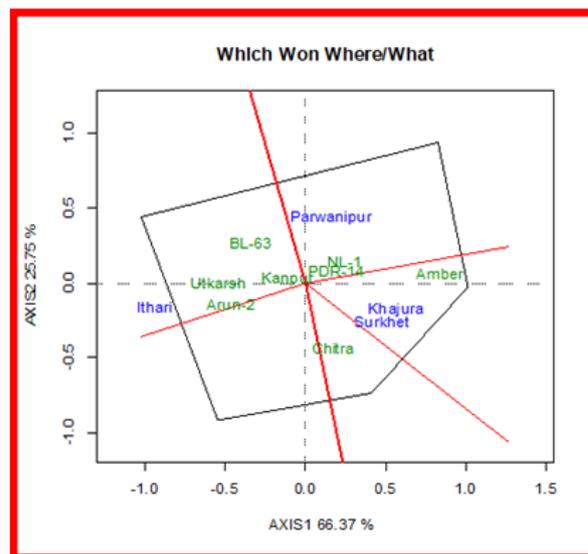


Fig. 4: Genotypes with specific environment and representativeness of the average environment

G x E interaction in GGE biplots in figure 1 illustrated that based on both mean and stability the best genotype was Amber then followed by PDR-14. In figure 2 base on concentric ring the ideal genotype was BL-63 however according to figure 3 Ithari was seen the best environment. In figure 4, genotype Amber and Chitra were found ideal and vertex to Khanjra and Surkhet environments, while NL-1 and PDR-14 were ideal for Parwanipur and BL-63, Utkarsh, Kanpur-1 and Arun 2 were found ideal for Ithari environment.

#### IV. DISCUSSION

Beans are consumed as whole seeds as vegetable or split forms, both as soup or 'daal'. Beans

contains healthy proteins, are consumed by all households. Indeed, black bean soup is given to their sick people as an energy supplement. Farmers in Nepal preferred bean landraces that are medium growth habit, early maturing nature, high yielding, good seed size and color and are high demand in the market (Chhetri and Bhatta 2017, Neupane et al 2008). A similar study was done in bean growing area in Malawi to understand the farmer's specifications for variety selection showed that farmers looked on grain color, cooking time, taste, grain size as well as grain brightness to choose the varieties (Chirwa and Phiri 2005). Stoilova et al. (2006) found that out of many accessions studied, some accessions with an erect habit, a shorter period to reach maturity had

higher number of pods and seeds per plant as these genotypes escaped unfavorable conditions of high daily temperature and low humidity during the flowering and pod formation periods. In the study, the genotypes had different flowering and pod maturity times even they were planted on the same date. Flowering and pod maturity occurred earliest for all the varieties in the khajura and surkhet than Itahari and Parwanipur site. This flowering data clearly indicated the environment particularly the temperature played an important role in physiological and phenological growth of the varieties included in the study. Similar results of common bean landraces at Mexico showed there were significant differences in the morphological and physiological traits of the plant, pod and grain among different geographic regions which were also associated with different indigenous groups (Chavez-Servia et al 2016). There was effect of genotype by environment interaction on the bean genotypes and yield traits. Some lines showed vertex that mean they were location specific while some lines were highly stable across the locations.

## V. CONCLUSION

The combined ANOVA showed that the highly significant differences among the genotypes and locations in the quantitative traits like Days to 50% flower, Days to maturity, Plant height, Hundred seed weight and grain yield. However the effect of GxE interaction was not found in Days to 50% flower, Days to maturity and Grain yield. Overall mean performances in terms of grain yield over the years and across the location showed that the genotype PDR-14 (1862 kg ha<sup>-1</sup>) produced the highest yield followed by Utkarsh (1698 kg ha<sup>-1</sup>) and Amber (1666 kg ha<sup>-1</sup>). Genotype PDR-14 gave 12-35% higher yield among the genotypes and its stability analysis test also indicated that PDR-14 was found a highly stable across the environments and over the years. Variegated red kidney shape seed, white flowers along with dwarf and glabrous leaf pubescence is the distinctness, uniformity and stability (DUS) testing trait of the PDR-14 and recommended for terai/inner terai to high hills.

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Table 1: Performance of Rajma genotypes in MLT at RARS, Parwanipur, 2015

S. No.	Genotypes	DF	DM	PLHT(cm)	PP	SP	GY (Kg/ha)	HSWT(g)
1	PDR 14	54b	112b	30c	11	3	966.0abcd	39.8a
2	Amber	50c	109c	29c	11	4	855.3cd	35.6cd
3	Utkars	64a	115a	46a	13	4	1079.3ab	29.3e
4	Arun -2	54b	112b	42ab	12	4	1150.0a	39.1a
5	BI- 63	50c	109c	26c	10	3	888.0bcd	36.9bc
6	Kanpur	54b	112b	39b	11	4	769.3d	35.1d
7	Chitra	50c	109c	25c	11	4	892.7bcd	36.6bcd
8	NI-1	50c	109c	26c	44	4	1026.7abc	38.1ab
	Mean	53.5	110.8	33.04	15	4	953.4	36.3
	P-value	0.000**	0.000**	0.000**	0.48	0.55	0.039*	0.000**
	F Value	0	99.6	26.93	1	1	3.0	33.9
	CV%	0	0.38	8.34	132	6	13.3	2.6
	LSD	0.00	0.75	4.82			222.1	1.70

Table 2: Mean data on phenology growth and Yield of MLT, GLRP, Khajura, 2015

S.No.	Genotypes	PLHT (cm)	PP	SP	GY (Kg/ha)	HSWT(g)
1	PDR 14	37	7	4	518	33
2	Amber	35	7	3	425	35
3	Utkars	39	6	5	465	30
4	Arun -2	48	7	5	542	35
5	BI- 63	33	7	4	515	33
6	kanpur	36	7	4	437	34
7	Chitra	36	6	4	430	36
8	NI-1	43	8	3	563	38
	Mean	38	7	4	487	34
	P value	0.00	1	0.00	1.0	0.00
	F Value	0.98	0.7	2	0.16	1.2
	CV%	21.6	18.4	16.31	18.49	10.15

Table 3: Mean data on phenology, growth and yield of MLT, GLRP, Khajura, 2016

S. No.	Genotypes	DF	DM	PLHT	PP	SP	HSWT(g)	GY (Kg/ha)
1	PDR-14	46	108	47	37	3.5	42	2471
2	Amber	45	112	4	12	4.1	40	1938
3	Utkarsh	46	112	55	11	3.5	37	2600
4	Arun-2	52	110	70	10	3.6	47	1579
5	BL-63	44	105	44	10	3.6	41	1517
6	Kanpur	45	110	46	11	4.3	40	1783
7	Chitra	44	100	39	10	3.2	39	1358
8	NL-1	43	95	44	10	3.3	41	1842
9	Pant-1	45	110	74	10	3.9	42	1983
	Mean	46	107	51.7	13	3.7	41	1897
	P-Value	0.4	<.001	<.001	0.46	0.181	0.002	0.05
	CV%	10.27	1.1	10	116.6	13	4.8	23.9
	LSD	NS	2.1**	8.9**	NS	NS	3.4**	*

Table 4: Mean data on phenology and growth and Yield of MLT, JRP, Itahari, 2016

S. No.	Genotypes	DF	DM	PLHT	PP	SP	GY (Kg/ha)
1	PDR-14	76	122	31	15	4	1412
2	Amber	75	122	31	17	4	1121
3	Utkarsh	82	121	33	16	4	1625
4	Arun-2	76	119	30	15	4	1396
5	BL-63	75	103	22	12	4	1046
6	Kanpur	75	109	30	11	4	892
7	Chitra	76	103	22	9	4	975
8	NL-1	75	105	23	12	4	896
	Mean	76	113	28	13	4	1170
	P-Value	<.001**	<0.001**	<.001**	0.08	0.44	0.03*
	CV%	1.3	0.8	8.3	25.5	9.6	23.1
	LSD	1.8**	1.5**	4.0**	NS	NS	473.6*

Table 5: Mean data on phenology growth and Yield of MLT, ARS, Surkhet, 2016

S. No.	Genotypes	DTF	DTM	PH	PPP	HGW	GY (Kg/ha)
1	PDR-14	47	114	48	22	40	2701
2	Amber	44	122	50	21	40	3146
3	Utkarsh	57	123	124	18	33	2986
4	Arun-2	46	121	106	20	44	3090
5	BL-63	46	110	36	17	39	2417
6	Kanpur	47	120	45	16	40	2319
7	Chitra	44	111	46	15	40	2583
8	NL-1	42	108	45	14	39	2970
	Mean	46	116	63	18	40	2777
	P-Value	<.001**	0.05	<.001**	0.36	0.018*	0.05
	CV%	4.4	5.4	15.5	25	6.8	13.3
	LSD	3.6	NS	17.0	NS	4.7	NS

Table 6: Mean data on phenology growth and Yield of MLT, RARS, Parwanipur, 2016

S. No.	Genotypes	DF	DTM	PH	PPP	SPP	HSWT (g)	GY (Kg/ha)
1	PDR-14	54	117	36	15	6	50	1369
2	Amber	54	121	32	19	6	44	1256
3	Utkarsh	62	121	75	14	7	48	1538
4	Arun-2	52	118	68	14	7	52	1070
5	BL-63	55	115	33	14	7	43	1015
6	Kanpur	57	116	40	11	7	46	828
7	Chitra	52	115	33	12	7	42	789
8	NL-1	54	114	34	15	6	42	868
	Mean	55	117	44	14	7	46	1092
	P-Value	0.001	<.001	<.001	0.11	0.58	<.001	0.006
	CV%	3.8	1	13.3	20.4	10.5	0.8	19.8
	LSD	3.7**	2.0**	10.3**	NS	NS	3.2**	378.9*

Table 7: Performance of Rajma Genotype in MLT GLRP, Khajura 2017

EN	Genotypes	DF	DM	Plht	PP	SP	GY
1	PDR 14	40	104	20	11	4	2319
2	Amber	40	107	13	14	5	1329
3	Utkarsh	54	106	21	10	5	1992
4	Arun-2	36	103	27	9	4	1722
5	BL63	35	90	16	12	5	1878
6	Kanpur	34	104	13	8	5	822
7	Chitra	34	91	14	10	5	1715
8	NL-1	34	89	15	11	4	1503
9	Pant-1	40	107	27	11	5	1725
10	Pant-2	35	99	19	8	5	1430
	Mean	38	100	19	10	5	1644
	P-value	<0.001	<0.001	<0.001	0.300	<0.001	0.025
	CV%	3.13	2.33	17.45	26.34	6.55	25.14
	LSD	2.05	3.99	5.55	4.71	0.53	708.86

Table 8: Combined analysis Rajma MLT across the location over the years (2015-2017)

S. No.	Genotypes	DF	DM	PLHT	PP	SP	HSWT(g)	GY(Kg/ha)
1	PDR-14	58	119	39	18	4	43	1862a
2	Arun-2	60	119	46	16	4	44	1433ab
3	Chitra	59	116	36	14	4	39	1478abc
4	Amber	58	121	37	17	4	41	1666bcd
5	BL-63	53	116	30	14	4	40	1300bcd
6	NL-1	52	111	31	16	4	35	1202d
7	Kanpur	63	121	42	19	4	40	1250cd
8	Utkarsh	62	120	37	14	4	40	1698
	Mean	59	118	37	17	4	40	1474
	P-value							
	Env	<0.001	<0.001	<0.001	0.500	0.100	<0.001	<0.001
	Gen	0.260	0.020	0.004	0.500	0.420	0.001	0.018
	Year	0.190	0.020	<0.001	0.120	0.300	<0.001	<0.001
	G X E	0.990	0.120	0.900	0.330	0.700	0.600	0.99
	CV %	13.00	5.2	27	31	11	12	31
	LSD							416.77

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# Participatory Evaluation of Oat and Vetch Varieties under Farmers Management in Bulle District Highland, Southern Ethiopia

By Worku B, Bangu B & Bereket Z

**Abstract-** Five oat and three vetch varieties were demonstrated and evaluated under farmers' management conditions at Seka kebele of Bulle Woreda, southern Ethiopia, with the objective of introduction and evaluation of different Oat Vetch species. The oat varieties were Lampton (standard check), CI-2291, CI-8251, CI-8237, and CI-2806, whereas the vetch varieties evaluated were *Vicia dasycarpa* (V.D), *Vicia Sativa* (V.S), and *Vicia villosa*. The varieties were planted in a 3 m x 4 m plots arranged in an RCBD design with four replications. The results indicated that the germination date was influenced by the effect of the year. Accessions like CI-2291 and CI-2806 had higher ( $p \leq 0.05$ ) dry matter yield than other accessions regardless of year effect, while accession CI-8251 and CI-8237 had higher seed yield than other accessions. Regarding vetch varieties, *Vicia sativa* had a significantly ( $P < 0.05$ ) higher dry matter yield. It is noted that both oat and vetch varieties were well adapted to the study area during both years. From the oat varieties, CI-2291 and CI-2806 could be recommended for herbage production, while CI-8237 and CI-8251 for seed production.

**Keywords:** dry matter yield, oat, vetch, adaptability, varieties, seed yield.

**GJSFR-D Classification:** FOR Code: 070199



*Strictly as per the compliance and regulations of:*



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**Abstract-** Five oat and three vetch varieties were demonstrated and evaluated under farmers' management conditions at Seka kebele of Bulle Woreda, southern Ethiopia, with the objective of introduction and evaluation of different Oat Vetch species. The oat varieties were Lampton (standard check), CI-2291, CI-8251, CI-8237, and CI-2806, whereas the vetch varieties evaluated were *Vicia dasycarpa* (V.D), *Vicia Sativa* (V.S), and *Vicia villosa*. The varieties were planted in a 3 m x 4 m plots arranged in an RCBD design with four replications. The results indicated that the germination date was influenced by the effect of the year. Accessions like CI-2291 and CI-2806 had higher ( $p \leq 0.05$ ) dry matter yield than other accessions regardless of year effect, while accession CI-8251 and CI-8237 had higher seed yield than other accessions. Regarding vetch varieties, *Vicia sativa* had a significantly ( $P < 0.05$ ) higher dry matter yield. It is noted that both oat and vetch varieties were well adapted to the study area during both years. From the oat varieties, CI-2291 and CI-2806 could be recommended for herbage production, while CI-8237 and CI-8251 for seed production. From the vetch varieties, *Vicia sativa* is the preferred variety for seed production, while *Vicia dasycarpa* and *Vicia villosa* are preferred for herbage production. Furthermore laboratory analysis and in vivo digestibility has to be conducted in the study areas.

**Keywords:** dry matter yield, oat, vetch, adaptability, varieties, seed yield.

## I. INTRODUCTION

One of the bottlenecks of livestock production in Ethiopia is feed shortage both in quantity and quality. In recent years, climate change is an additional threat playing valuable role in challenging the development of feed resources (Dinesh *et al.*, 2014). Crop residues and natural pasture are the major feed resource in developing countries. However, crop residues are low in protein, energy, and other important micronutrients essential for animal production (Ramana *et al.*, 2015). Animals fed on these feed sources could hardly meet their nutritional requirements and livestock productivity in terms of meat and milk.

The feed and feeding problem of livestock production is more profound in most high land areas of the southern region of the country. The shortage of feed

is usually the worst during the late dry season across the region as well as the country level. Efforts were made to fill the gaps since Fourth Livestock Development Project (Mengistu *et al.*, 2017), with the significant steps in forage seed production to improve feed supply in quantity (Getnet, 2003). Moreover, a baseline survey conducted in the study area indicated that shortage of feed is one of the factors limiting the productivity of livestock in the area (unpublished report of HARC, 2016) demanding introduction and evaluation of improved forage species to fill the gap.

Oat and vetch are proven for their adaptability and yield potential in highland areas. Farmers usually practice oat planting either as a sole crop or in mixed stands with vetch for ruminant feeding (Kebede *et al.*, 2016). These varieties were tested for their high yielding potential at the Bulle sub-station. Therefore, these varieties were proposed for demonstration at farmers' fields to introduce variety, management, and utilization practices. Hence, this study was conducted to demonstrate and evaluate various oat accessions and vetch varieties at farmers' fields.

## II. MATERIALS AND METHODS

### a) Description of the study site

Bulle woreda is located at 395 km from Addis Ababa or 86 km from the regional capital Hawassa with an altitude of 2676 *m.a.s.l* and latitude N07'21.469 and longitude E037'47.945. The area is known with two (heavy and light rainy) seasons with clearly demarcated features. It is mainly crop-livestock mixed farming system predominately Enset based coffee-agroforestry and crop-livestock farming system.

### b) Site selection and land preparation

Seka kebele of Bulle woreda is characterized by highland agro-ecology with undulating topography, the steepness of the slope varying between 0-45%. As a result, appropriate and plain site selection was one of the pre-conditions before planting. Five oat accessions and three vetch varieties were planted in well-prepared seedbed at Seka Kebele at four farmers' field, considering farmers as a replication.

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c) Sources of varieties and experimental design

Five oat varieties namely, Lampton (local), CI-2291, CI-8251, CI-8237, and CI-2806 sourced from Holetta Agricultural Research Center, were planted in the second week of July 2016 and 2017 in a plot size of 3 m x 4 m arranged in RCBD design with three replications. The seed rate was 100 kg/ha for oats and 25 kg/ha for vetch with a fertilizer rate of 100 kg NPS/ha. The varieties were planted by drilling 30 cm between rows, 2 m between blocks and 1 m between plots. Similarly, three vetch varieties namely *Vicia dasycarpa* (V.D), *Vicia Sativa* (V.S), and *Vicia villosa* (V.V) were planted in RCBD with four replications. The plot size was 3 mx4 m (12 m<sup>2</sup>); 2 m between blocks and 1 m between plots.

d) Data collection and management

In this experiment, date of germination, date of 50% flowering, plant height, number of branches per plant, dry matter yield and seed yield were recorded. During sampling each plot was divided into two half crosswise with an effective plot size of 2 m \* 3 m. half of the plots were used for forage sampling, and the other half for seed yield determination. Forage and dry matter yield were determined by harvesting half of the plot. Plants were harvested by hand. The dry matter yield was calculated after drying a sample of 500 g green forage in an oven at 105°C for 24 hours in the soil laboratory of Hawassa Agricultural Research Center. The plant height was measured by averaging the natural standing height of ten plants per plot. At 50% flowering, forages were harvested for herbage and dry matter yield. The number of tillers per plant was taken from ten plants per plot.

e) Data management

The data collected were subjected to analysis of variance using the general linear model (GLM) procedure in SPSS (version 20) and mean separation was done using Tukey's test at 5% probability level. The model employed was:

f) Statistical model

$Y_{ij} = \mu + b_j + V_i + e_{ij}$ , Where;  $Y_{ij}$  = response variables (DM, plant height, number of tillers)

$\mu$  = Overall mean

$B_j$  = Block effect

$V_i$  = the effect of oat varieties (  $i=1, 2,3,4,5$ ) and vetch varieties ( $i=1,2,3$ )

$e_{ij}$  = Random error

### III. RESULTS AND DISCUSSION

a) Yield and yield components of oat (*Avena sativa*)

Effect of accession and year on yield attributes and yield of oat are given in Tables 1-3. This study indicated that the yield and yield components of oat and vetch were influenced by varietal differences. Yield and yield components of oat (*Avena sativa*) are indicated in

Table 1. Germination date was significantly ( $P<0.05$ ) affected by varietal (accession) differences. CI-2806 variety emerged late compared to others. Year effect also has shown a bit variation on number of date taken to germinate, in 2016 cropping season all varieties were germinated at least one day lesser than the second cropping year, which might be due to lack of sufficient moisture in the soil in year two cropping season.

Table 1: Effect of accession and year on germination date of Oats

Treatment	Year	Mean	Std. Error
Standard check	2016	8.0a	.11
	2017	10.0b	.11
CI-2291	2016	8.0a	.11
	2017	9.0a	.11
CI-8251	2016	9.0a	.11
	2017	8.3a	.11
CI-8237	2016	9.0a	.11
	2017	10.3a	.11
CI-2806	2016	10.0a	.11
	2017	11.0a	.11

b) Dry matter yield

The dry matter yield varied between 5.5-8.4 tons per hectare. In this study year had no significant role on dry matter yield variation at ( $p<0.05$ ). On the other hand, varieties had a statistically a significant effect on dry matter yield. CI-2806, had significantly ( $p<0.05$ ) higher yield followed by CI-2291.

Table 2: Effect of accession and year on Dry matter yield of Oat

Accession	Year	Mean	Std. Error
Standard check	2016	6.350	.247
	2017	7.250	.247
CI-2291	2016	8.375	.247
	2017	7.100	.247
CI-8251	2016	5.500	.247
	2017	6.925	.247
CI-8237	2016	6.275	.247
	2017	5.675	.247
CI-2806	2016	8.375	.247
	2017	8.275	.247

Table 3: Effect of year and accession on seed yield of oat string

Accession	Year	Mean t/ha	Std. Error
Standard check	2016	2.98 <sup>a</sup>	.130
	2017	2.93 <sup>a</sup>	.130
CI-2291,	2016	2.30 <sup>b</sup>	.130
	2017	2.55 <sup>b</sup>	.130
CI-8251,	2016	3.30 <sup>a</sup>	.130
	2017	3.35 <sup>a</sup>	.130
CI-8237,	2016	3.20 <sup>a</sup>	.130
	2017	3.03 <sup>a</sup>	.130
CI-2806	2016	2.88 <sup>ab</sup>	.130
	2017	2.48 <sup>b</sup>	.130

c) *Vetch species*

Yield and yield components of vetch (*Vicia* varieties) are presented in Table 4 and Table 5. *Vicia* accessions had significant effect on the date of germination, the number of tillers, and plant height. *Vicia sativa* had significantly ( $p < 0.05$ ) higher date of germination, while the differences between *V. dasycarpa* and *V. villosa* was not significant. *V. sativa* and *V. villosa* took longer days to reach 50% flowering compared to *V.*

*dasycarpa*. The difference between relatively early maturing and late-maturing varieties was about 13 days. The findings of this study were similar to reports of (Kebede *et al.*, 2016), who noted 25 days difference between *Vicia* varieties. *Vicia sativa* and *V. villosa* had a significantly higher number of tiller than *V. dasycarpa*. There was no year effect on yield components of the accessions.

Table 4: Effect of accession on date germination, date of 50% flowering, plant height, number of tillers of vetch

Dependent Variable	Accession * year		Mean	Std. Error	
	Accession	Year			
Date of germination	Vicia sativa	2016	14.0	.34	
		2017	14.5	.34	
	Vicia villosa	2016	15.78	.34	
		2017	16.0	.34	
	Vicia dyscarpa	2016	15.7	.34	
		2017	17.0	.34	
50% flowering date	Vicia sativa	2016	82.2a	.93	
		2017	83.7a	.93	
	Vicia villosa	2016	72.5b	.93	
		2017	73.3b	.93	
	Vicia dyscarpa	2016	72.3b	.93	
		2017	69.5b	.93	
	Plant height	Vicia sativa	2016	89.6b	1.39
			2017	77.3bc	1.39
Vicia villosa		2016	119.5a	1.39	
		2017	119.0a	1.39	
Vicia dyscarpa		2016	109.0a	1.39	
		2017	110.5a	1.39	
Number of tiller/plant		Vicia sativa	2016	20.3a	.52
			2017	19.5a	.52
	Vicia villosa	2016	19.3a	.52	
		2017	20.5a	.52	
	Vicia dyscarpa	2016	16.0b	.52	
		2017	16.0b	.52	

d) *Dry matter yield and seed yield of vetch species*

*Vicia sativa* had higher ( $p < 0.05$ ) seed yield compared to other varieties. The dry matter yield of *V. dyscarpa* was a higher at ( $p < 0.05$ ) than other vetch varieties. The seed yield of the evaluated vetch varieties ranged between 3.1 t/ha for *V. dasycarpa* in 2017 to 4.4 t/ha for *V. sativa* in the same year. The seed yield obtained in the current study was by far higher than the results reported by (Kebede *et al.*, 2016) at Holeta and Ginchi sites of the central highland Zones of Ethiopia. It was also reported by Mengistu (2017) that the potential of forage seed production has not been exploited across regions and ecological zones due to various barriers.

Table 5: Effect of accession on dry matter, DM yield (ton DM/ha) and seed yield (100 kg/ ha) of vetch

	Variety * year		Mean	Std. Error
	Variety	year		
DM yield	Vicia sativa	2016	5.62 <sup>b</sup>	.068
		2017	5.15 <sup>b</sup>	.068
	Vicia vilosa	2016	5.02 <sup>b</sup>	.068
		2017	5.00 <sup>b</sup>	.068
	Vicia dasycarpa	2016	6.32 <sup>a</sup>	.068
		2017	6.20 <sup>a</sup>	.068
Seed yield	Vicia sativa	2016	4.27 <sup>c</sup>	.091
		2017	4.35 <sup>c</sup>	.091
	Vicia vilosa	2016	3.17 <sup>d</sup>	.091
		2017	3.27 <sup>d</sup>	.091
	Vicia dasycarpa	2016	3.30 <sup>d</sup>	.091
		2017	3.12 <sup>d</sup>	.091

#### IV. CONCLUSION

The evaluated oat and vetch varieties were well adapted to the study area at both years. From the oat varieties, CI-2291 and 2806 were superior in most parameters, Dry matter yield, in contrast to this, CI-8237 and CI-8251 had a higher seed yield than other varieties and are recommended, for use in Bulle and similar agro-ecologies. Likewise, from the vetch varieties, *Vicia dasycarpa* had a higher dry matter yield, and thus, it can be recommended for Bulle and similar environments. *Vicia villosa* could be recommended followed by *Vicia dasycarpa* for dry matter yield. In contrast *V. Sativa* is preferably recommended for seed production.

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# Increasing Energy Efficiency of the Executive Mechanisms of Intellectual Systems

A Djalilov <sup>α</sup>, R Baratov <sup>σ</sup>, E Sobirov <sup>ρ</sup>, M Begmatov <sup>ω</sup> & X Valixonova <sup>¥</sup>

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## I. INTRODUCTION

To ensure a stable and guaranteed water supply for all segments of the population and the economy, our country is carrying out large-scale work to develop irrigation, improve water infrastructure and reclamation of irrigated lands, efficient and rational use of land and water resources.

However, due to global climate change, population growth and increasing demand for water from year to year, the growing shortage of water resources may be one of the main limiting factors for the future development of the country.

Insufficient introduction of modern water and energy saving methods and technologies in the water sector, that is, open irrigation networks, the introduction of scientific achievements and know-how, as well as the widespread use of modern information and communication technologies and innovative solutions hinder the development of the industry.

Consequently, the effective management of water resources and rational use of water in the country, the reform of water management and the widespread introduction of market principles and mechanisms, information and communication technologies and energy efficient technologies, as well as the effective use of scientific potential in the field of water and food security.

## II. METHOD

In Uzbekistan, flat and rectangular vertical opening slide gate are widely used in water distribution

networks. To determine the value of the hydrostatic pressure force on a straight rectangular flat surface, the following studies are necessary. Determination of the pressure force is one of the important parameters when choosing the design of a hydraulic gate or other hydraulic systems.

Figure 1 below shows a schematic of a flat vertical moving slide gate. It is known from the course of fluid mechanics that the force of hydrostatic pressure acts perpendicular to a flat surface. Usually the force exerted by the hydrostatic pressure is located at the center of gravity of the flat body (see the point in Figure 1) [1,2].

Consider a completely closed state of the gates, in which case the upstream head (water level) in the head water will have a maximum value. The  $S = H_{up,max} \cdot b$ ,  $m^2$  formula is used to determine the total surface area of a hydraulic gate under hydrostatic pressure, where  $H_{up,max}$  – upstream head (water level) or height of the gate (m),  $b$  – width of the gate (m). As we know, the expression for the effect of hydrostatic pressure is as follows [2,4,5].

$$F_R = \rho \cdot g \cdot \frac{H}{2} \cdot S = \rho \cdot g \cdot \frac{H}{2} \cdot H \cdot b = \frac{1}{2} \rho \cdot g \cdot H^2 \cdot b \quad (1)$$

This expression can be used in practice for any case of hydraulic gates. However, to determine the coordinate dependence of the forces acting on the flat surface of hydraulic gates, we analyze gates with a flat surface moving vertically.

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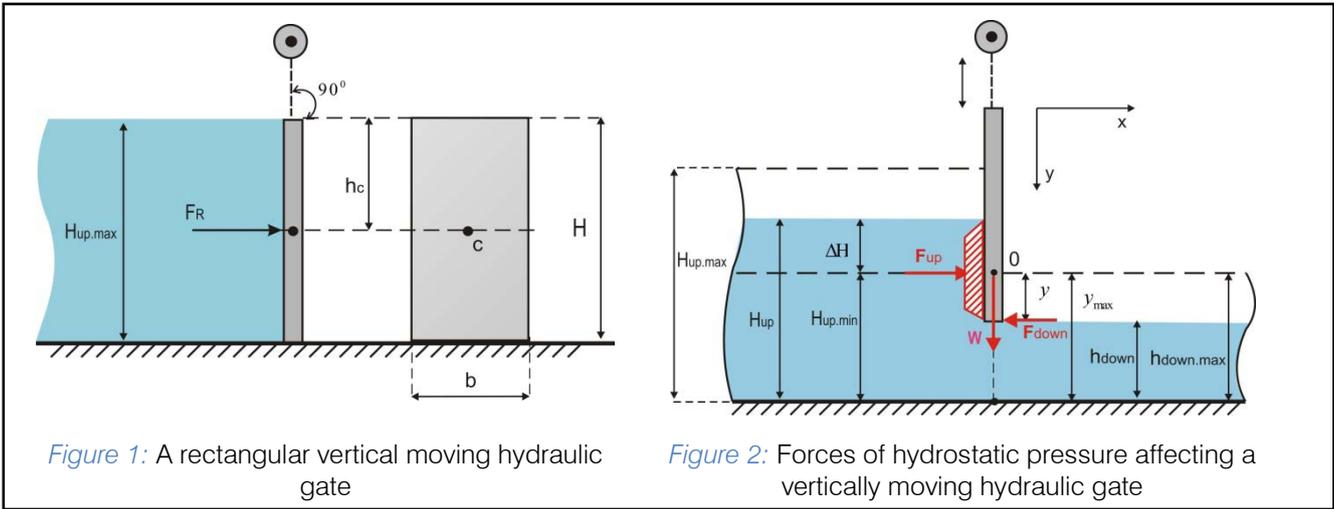


Figure 1: A rectangular vertical moving hydraulic gate

Figure 2: Forces of hydrostatic pressure affecting a vertically moving hydraulic gate

Figure 2 shows the hydrostatic pressure forces affecting on a vertically moving hydraulic gate. The resulting hydrostatic pressure force is equal to the following [4,5]:

$$F_R = F_{up} - F_{down} \quad (2)$$

where  $F_{up}$ ,  $F_{down}$  - are the forces affecting the hydrostatic pressure in the upstream and downstream, respectively.

The hydrostatic pressure force  $F_{down}$  at the bottom is very small and can be ignored, therefore:

$$F_R = F_{up} \quad (3)$$

An important parameter in determining the total forces affecting the flat surface of the hydraulic gate is the water level in the upstream and downstream of the canal. Taking into account the laws of water level change in the upstream and downstream, we determine the total force of hydrostatic pressure affecting the hydraulic gate as follows [4,5,6]:

$$F_{overall} = k(f \cdot F_R \pm W) = k\left[\frac{1}{2} \cdot f \cdot \rho \cdot g \cdot b \cdot (H_{up.min} + \Delta H \cdot y - h_{down.max} (y_{max} - y))^2 \pm W\right] \quad (4)$$

where  $k$  - reserve coefficient,  $W$  - weight of the gate (N),  $f$  - friction coefficient (dimensionless coefficient),  $H_{up}$ ,  $H_{up.min}$  - water level in the upstream and its minimum value,  $\Delta H$  - difference between the water level in the upstream and its minimum value,  $h_{down}$ ,  $h_{down.max}$  - downstream water level and its maximum value,  $y$ ,  $y_{max}$  - coordinate of the hydraulic gate and its maximum value.

In equation (4) weight of the gate ( $W$ ) has negative and the positive sign means that weight of the gate at the closing process has the same direction with closing force helping to close the gate and at the opening process directed opposite to the opening force. A positive value means that the movement of the gate follows the direction of the gate weight vector. A negative value means that the direction of movement of the gate and the vector of the weight of the gate are in the opposite movement.

In figure 3 shows the curve of changes in hydrostatic pressure affecting the flat surface of the gate due to the movement of the coordinate of the hydraulic gate.

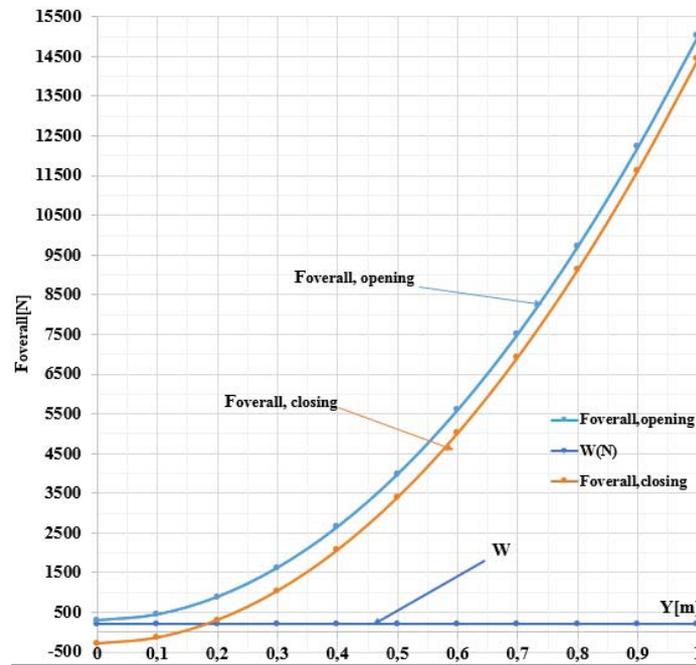


Figure 3: Coordinate dependence of the hydrostatic pressure force affecting on a flat surface when opening and closing a vertically moving gate

It is known from the graph that the influence of hydrostatic pressure is less when closing the valve than when opening it. There is a big difference between these impact forces and it will be the basis for us to analyze water level and flow control and energy-saving designs of control systems. From the point of view of the design of the hydraulic gate under analysis, it can be observed that in the preparation, installation and operation of the hydraulic gate there are some shortcomings in the management system of such a gate:

- An increase in the weight of the gates requires an increase in the electric motor power of the gates accordingly;
- Corrosion of mechanisms, gearing of drive mechanisms and other additional loads lead to an increase in energy consumption accordingly.

The power consumption of a vertically moving hydraulic gate is determined as follows:

$$P = \frac{F_{\text{overall}} \cdot v}{\eta} \tag{5}$$

where  $F_{\text{overall}}$  - total force affecting the gate,  $\eta$  - total F.I.K. lifting mechanism,  $v$  - lifting speed.

$$S_{\text{down}} = b \cdot h_{\text{down}} \text{ or } S_{\text{down}} = b \cdot h_{\text{down}} = b \cdot h_{\text{down,max}} \cdot \sin(\alpha_{\text{max}} - \alpha) = b \cdot h_{\text{down,max}} \cdot \cos\alpha \tag{6}$$

where  $\alpha$ ,  $\alpha_{\text{max}}$  - then angle of rotation of the gate and its maximum value,  $\alpha_{\text{max}} = 90^\circ$ .

From the construction shown in Figure 4, the following can be written:

$$H_{\text{up}} = L + L', \text{ where } L' = H \cdot \sin\alpha, \text{ or } L = H_{\text{up}} - L' = H_{\text{up}} - H \cdot \sin\alpha. \tag{7}$$

The level from the water surface in the headwater to the center of the partition is as follows:

The second type - the determination of the water flow rate in hydraulic gates moving at a certain angle, depends on the angle of rotation of the gates and the water level (Figure 4) [3,4].

Currently, this method of monitoring and measuring water flow in open canals is most widespread due to the following advantages: small amplitude of oscillations of the surface wave of water when adjusting the flow rate, simplicity of design, as well as the ability to perform a large range of measurements when measuring, adjusting the level and flow of water - one of the benefits.

The rotating part of the hydraulic gate, which moves at a certain angle, is attached to the lower part of the channel, and the upper part is connected to the drive mechanism by means of two cable wires. As the angle of rotation of the flat basin changes, the water level in the upstream and downstream changes accordingly.

A number of theoretical and experimental studies have been conducted to determine the energy savings of this construction and a mathematical model of it has been developed accordingly.

$$h_c = L + \frac{1}{2}L' = H_{up} - H \cdot \sin\alpha + \frac{1}{2} \cdot H \cdot \sin\alpha . \tag{8}$$

Using expressions (7) and (8), we get:

$$h_c = H_{up.min} + \Delta H \cdot \sin\alpha - H \cdot \sin\alpha + \frac{1}{2} \cdot H \cdot \sin\alpha = H_{up.min} + \left( \Delta H - \frac{1}{2} H \right) \cdot \sin\alpha \tag{9}$$

Multiplying the level  $h_c$  from the water surface to the center of the hydraulic gate of water on the surface of the headwater ( $S_{up}$ ), we determine the force of hydrostatic pressure affecting on the upper surface of the hydraulic gate as follows [4,5]:

$$\begin{aligned} F_{up} &= \rho \cdot g \cdot h_c \cdot S_{up} = \rho \cdot g \cdot \left( H_{up.min} + \left( \Delta H - \frac{1}{2} H \right) \cdot \sin\alpha \right) \cdot b \cdot H = \\ &= \rho \cdot g \cdot w \cdot \left[ H_{up.min} + \left( \Delta H - \frac{1}{2} H \right) \cdot \sin\alpha \right] \cdot H . \end{aligned} \tag{10}$$

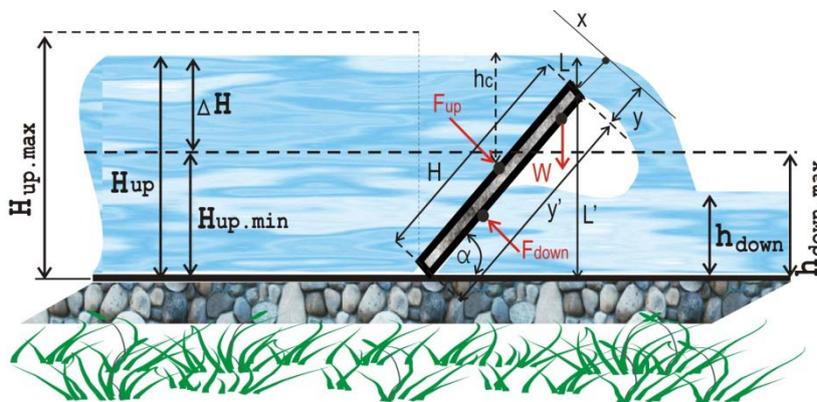


Figure 4: Straight rectangular valve moving at a specific angle

This design has a hydrostatic pressure force that also affects the downstream and must be taken into account. Because in some cases the water level in the downstream is a much larger value and the hydrostatic

pressure force depends on the value of this water level. Therefore, the water level in the downstream to the center of the immersed surface is as follows:

$$h_c = \frac{1}{2} h_{down} = \frac{1}{2} h_{down.max} \cdot \sin(\alpha_{max} - \alpha) = \frac{1}{2} h_{down.max} \cdot \cos\alpha \tag{11}$$

In this case, the hydrostatic pressure force generated by the downstream is as follows [4,5]:

$$\begin{aligned} F_{down} &= \rho \cdot g \cdot h_c \cdot S_{down} = \frac{1}{2} \rho \cdot g \cdot h_{down.max} \cdot \cos\alpha \cdot b \cdot h_{down.max} \cdot \cos\alpha = \\ &= \frac{1}{2} \rho \cdot g \cdot w \cdot [h_{down.max} \cdot \cos\alpha]^2 = \frac{1}{2} \rho \cdot g \cdot b \cdot h_{down}^2 . \end{aligned} \tag{12}$$

Compared to a vertical hydraulic gate, several forces act on this type of hydraulic gate during opening. In particular, these are: the weight of the hydraulic gate, friction resistance, that is, the resistance caused by the hydrostatic force acting on both sides of the gate.

Thus, the sum of the forces affecting on the horizontal hydraulic gate is:

$$F_{overall} = \pm F_{up} \mp F_{down} \pm W . \tag{13}$$

The resulting force, known from expression (13), has positive and negative components, and these expressions depend on the direction in which the gate moves up or down. For example, a negative sign means that the hydraulic gate moves in the same direction with the force that drives it during opening or closing.

(4) The values of the total force acting on the horizontal hydraulic gate during its opening or closing are as follows:

When lifting (closing) the gate

$$F_{\text{overall closing}} = k(f \cdot F'_{\text{over.closing}} \pm W) = k \cdot \left[ f \cdot \rho \cdot g \cdot b \cdot \left( (H_{\text{up.min}} + (\Delta H - \frac{H}{2}) \cdot \sin \alpha) \cdot H - \frac{1}{2} (h_{\text{up.max}} \cdot \cos \alpha)^2 \right) + W \cdot \cos \alpha \right] \quad (14)$$

When lowering (opening) the gate

$$F_{\text{overall opening}} = k \cdot \left[ -f \cdot \rho \cdot g \cdot b \cdot \left( (H_{\text{up.min}} + (\Delta H - \frac{H}{2}) \cdot \sin \alpha) \cdot H - \frac{1}{2} (h_{\text{down.max}} \cdot \cos \alpha)^2 \right) - W \cdot \cos \alpha \right] \quad (15)$$

Thus, we construct a graph of the coordinate dependence of the hydrostatic pressure forces affecting on the gate during lifting and lowering (Fig. 5).

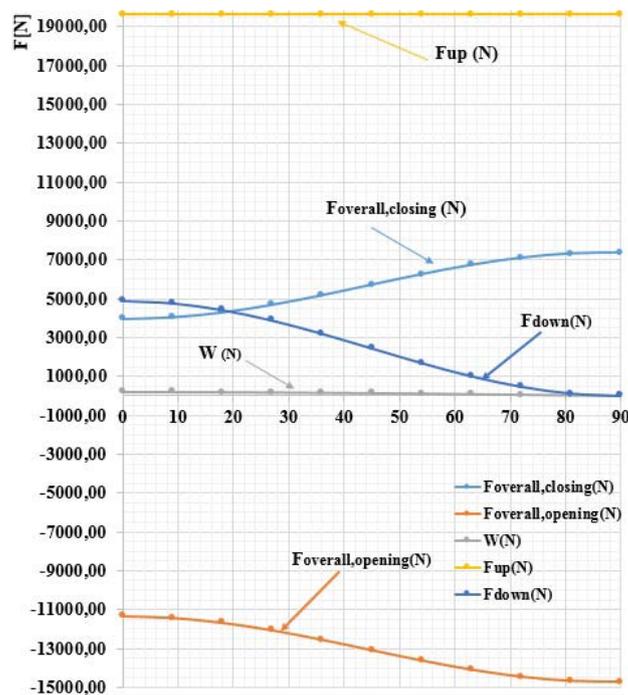


Figure 5: Forces of hydrostatic pressure acting on a hydraulic gate moving at a certain angle

### III. RESULTS AND DISCUSSIONS

Analysis of this process showed that the hydrostatic pressure force ( $F_{\text{up}}$ ) in the headwater can be constant or variable depending on the channel parameter. But the change interval is not very large. The difference in the hydrostatic pressure forces affecting on the hydraulic gates during opening and closing is approximately 18760 N. This value is 32 times less than the force affecting on the vertically moving gate. Optimization of several process parameters of the system control and monitoring improves the energy efficiency of hydraulic gates.

Nowadays, most hydraulic gates have an automatic control and monitoring system.

During irrigation, a large amount of electricity is required to control and monitor the condition of the

hydraulic gates. In addition, many hydraulic gates or water distribution points are located far from power lines, which creates additional difficulties in the operation of open canals. The above problems require the development of energy-saving systems for the control and monitoring of the state of hydraulic gates.

- Typically, the following two elements of hydraulic gates are the main energy consumers:
- Screw or chain gate lifting mechanism;
- Reducers to control the speed of movement of hydraulic gates.

Electric motors are the main gate control mechanism. Several parameters increase power consumption. For example, high-speed gates consume a lot of electricity.

The power of the electric motor for lifting and opening the gate is determined by the following expression:

$$P = \frac{F_{\text{overall closing}} \cdot v}{\eta}, \quad (16)$$

$$P = \frac{F_{\text{overall opening}} \cdot v}{\eta}, \quad (17)$$

where  $F_{\text{overall closing}}, F_{\text{overall opening}}$  - opening is the total force affecting the gate,  $\eta$  - the total F.I.K. lifting mechanism,  $v$

- lifting speed. Typically, the lifting speed  $isv=0,25-0,3$  m/min, and the overall F.I.K of the hoist depends on which mechanism is used. For example, if a screw mechanism is used for lifting, its F.I.K is  $\eta=0,63-0,85$ .

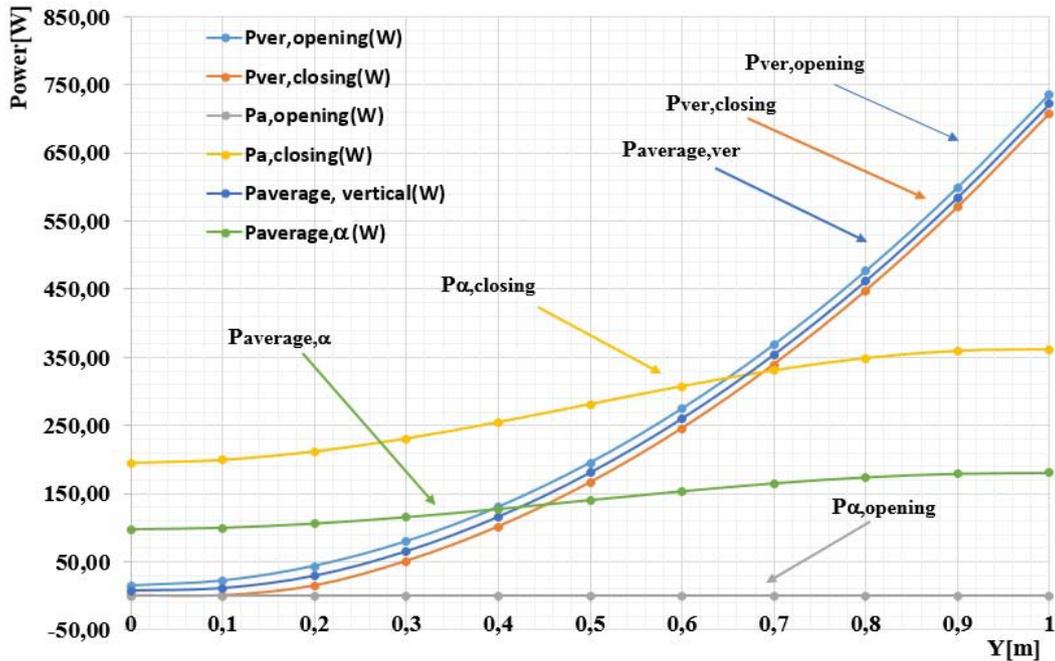


Figure 6: Power consumption of electric motors at a certain angle and vertically moving gates

#### IV. CONCLUSIONS

Analyzing the energy consumption for the coordinate movement of the gates from Figure 6, we can conclude the following:

- The average power required under the same conditions is 236.69 W for vertically moving gates and 139.88 W for hydraulic gates moving at a certain angle. Based on this energy consumption, if we compare the vertical and certain angles under the same conditions, then hydraulic valves moving at a certain angle consume 1.8-2 times less energy than vertical ones;
- Intellectual control and measurement system optimization of several parameters of the working process improves the energy efficiency of hydraulic gates;
- Reducing the energy consumption of the intellectual system execution mechanism allows to increase the efficiency of the system.

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## Length - Weight Relationship and Feeding Habit of *Oreochromis niloticus* in Wudil River, Kano State, Nigeria

By Dambatta M. A, A. O. Sogbesan, A. B. Dauda & M. A. Haruna  
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**Abstract-** The aim of this study is to determine the length - weight relationship and feeding habits of *Oreochromis niloticus* in Wudil river Kano state Nigeria. The Length-Weight relationship and feeding habit of *Oreochromis niloticus* in Wudil river was investigated using One hundred (100) specimens of *Oreochromis niloticus*. Samples were obtained from the catch of fishermen at landing sites for three months. Fish specimens randomly were easily identified by the dark bands/r stripes found on their tail. Samples were chilled in iced blocks at the point of collection before being transported in a plastic container to the laboratory for further analysis. Total lengths and weights were measured using standard method. The guts were The result of length - weight regression analysis of *Oreochromis niloticus* is shown in figure I for male, figure II for female II, and combine figure III 12.87, 15.29 and combine sexes 13.72 respectively all indicated allometric growth. The length - weight relationship of male figure I, female figure II and combine sexes figure III showed linear relationship with the significance coefficient of 0.887, 0.939 and 0.904 respectively at 0.05 per cent between length and weight.

**Keywords:** length, weight, feeding, wudil river, kano state.

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# Length - Weight Relationship and Feeding Habit of *Oreochromis niloticus* in Wudil River, Kano State, Nigeria

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**Keywords:** length, weight, feeding, wudil river, kano state.

## I. INTRODUCTION

### a) Back ground of the study

Fishes are highly important in the development of Nigeria both economically and health wise; as source of protein and dietary lipid with low cholesterol level in the diets of many populace. Knowledge of some quantitative aspects such as length-weight of fish is an important tool in the study of fish biology. The condition factor in fish serves as an indicator of physiological state of the fish in relation to its welfare (Le Cren, 1951). It also provided information when comparing two populations living in certain density, climate and other environmental conditions (Weatherly and Gills, 1987). In sub-saharan Africa, fish accounts for 10% of the animals' protein consumed, and 98% of this is finfish (Belgado and McKenna, 1997). The average per capita consumption

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of fish in Africa in 2007 was about 8.5kg per year having increased from an average of 7kg per annum from 1969-1974 (Ahmed, 1997). Almost 40% of fish consumed in Africa is freshwater fish as compared to the global average of 25%. In West Africa, finfish is largely consumed, while per capita, consumption growth is unlike in the Asia Continent (Bonga, 1999). When fishes are kept in lentic water, their feeding capacity tends to be negatively affected, more especially in polluted water. Dams and/or reservoirs have downstream effects on riverine environments and subsequently blocked nutrient-flow along the strata of the ecosystem. Thus, affecting the fish's production in the downstream of the reservoirs and river channels. Haruna (2003) reported that some aquatic plants that are hazardous to navigation and fishing show explosive population growth in new impoundments e.g. *Phragmites*, *Typhaspp* and *Cyprus spp* in Lake Jakara. Growth of fish is subjected to natural environmental changes particularly climate. However, some problems are course by human activities including fishing where more fishes are taken than are replaced by birth and subsequent new fish recruitment and growth. Like any other morphometric characters, the length-weight relationship (LWR) can be used as character for the differentiation of taxonomic units and the relationship changes with the various development events in life such as metamorphosis, growth and onset of maturity (Thomas *et al.*, 2003). Length-weight relationship parameters are useful in fisheries science in many ways; to estimate weight of an individual fish from its length, to calculate condition induces, to compare life history and morphology of population belonging to different regions (Saniet *et al.*, 2010) and to study on to genetic allometric changes (Teixeira de Mellon *et al.*, 2006).

## II. MATERIALS AND METHOD

### a) Study area

Kano state is a state located in Northern - Western Nigeria, created on May 27, 1967 from part of northern region, Kano state borders Katsina state to the north -west, Jigawa state to the north -east, Bauchi state to the south -east, and Kaduna state to the south - west, The capital of Kano state is Kano. Subsistence and consumption agriculture is mostly in the outlying districts

of the state. Some of the food crops cultivated are millet, sorghum, maize and rice for local consumption while groundnuts and cotton are produced for export and industrial purposes.

Wudil local Government area in Kano state is 44km away from Kano city Maiduguri road, also the channel that links Kano Gombe, Yola, Jigawa, and Bauchi states. Most of the people in Wudil are fish and sand Packers, due to the presence of Wudil River, it's headquarter is in Wudil town on the A237 highway. It has an area of 362km<sup>2</sup> and a population of 185, 189 at the 2006 census. Its coordinates lies between 11°49'N 8°51'E coordinates: 11°49'N 8°51'E'. The postal code of the area is 713. River Kogin Wudil is a stream and is located in Jigawa state, Nigeria. The estimate terrain elevation above sea level is 394 meters. Its latitude lies between 12°3'55.15" while longitude lies between 8°59'41.42'.

### III. METHOD OF DATA COLLECTION

Hundred (100) *Oreochromis niloticus* were sample randomly at Wudil River, Kano state from the catch of fishermen at landing sites. They were easily identified by the dark bands or stripes found on their tail. Identification of fish species was also done using field guide by Olaosebikan and Raji (1998) and FAO (1992) samples were chilled in iced blocks at the point of collection before being transported in a plastic jerry can to the laboratory.

### IV. LABORATORY ANALYSIS

The samples were mopped on filter paper to removed excess water from their body surface. The total length was measured in centimeter. The total was measured as the distance from the tip of the snout to the caudal peduncle, the body weight of each specimen was taken using a top loading mettle balance (LP502.A) to the nearest 0.0 g after drying excess water with filter paper.

### V. LENGHT - WEIGHT RELATION

The length - weight relationship was determined using conventional formula described by Le cren (1951) and used by Kefas and Abubakar (2010).

The length - weight relationship was determined using conventional formula described by Le cren (1951) and used by Kefas and Abubakar (2010).

$$W = aL^b$$

Where

W= The weight of fish in grams

L = The total length of fish in cm.

a = Exponent describing the rate of change of weight with length (=The intercept of the regression line on the Y axis)

b = The slope of the regression line (also referred to as the Allometric coefficient)

The equation and the data were transformed to before determination was made. The equation was therefore be transformed into.

$$\text{Log}W = \text{Log}a + b\text{Log}L$$

Where W. = weight of fish in grams.

L = length of fish in cm

a = constant.

b = an exponent.

### VI. CONDITION FACTOR

The condition factor (k) was determined for individual fish using the conventional formula describe by Worthington and Richard (1931) as adopted by Ja'afaru and Tashara (2009). The ratio of the length to the weight of the fish was determined as.

$$K = \frac{W \times 100}{L}$$

Where, K = condition factor.

W = weight of fish in grams

L = length of fish in cm

### VII. SEX DETERMINATION

Each specimen was dissected ventrally with the aid of a small scissors inserted through the vent. Also a semicircular cut was made laterally on the side of specimen for better observation. The gonads which are two parallel tubules located on the dorsal wall of the abdominal cavity were then examined with the naked eye in the case of sexually mature forms and dissecting microscope was employed for examination of the sexually maturing forms. Males have gonads with smooth exterior, while the females have gonads with a rough exterior (Olurin and aderibigbe., 2006).

### VIII. DATA ANALYSIS

All data collected were subjected to statistical analysis. ANOVA, Regression and Correlations were used to determine the relationship and association between data and parameters. Bar chart were also used to express data.

### IX. RESULT AND DISCUSSION

The result of length - weight regression analysis of *O. niloticus* is showing in figure i, ii, iii. The value for males 12.87, female 15.29 and combine sexes 13.72 all indicated allometric growth. The length - weight relationship of male figure (i), females figure (ii) and combine figure (iii) showed linear relationship with the significance coefficient of 0.887, 0.939 and 0.904 respectively at 0.05 per cent between length and weight. The condition factor (k) for all fish samples was

determined from the average length and weight of all the fish as shown in table 1 males 2.2875, females 2.9480 and combine sexes 2.5967 which is an indication of the fish been healthy since they are all above 1.0.

The length weight relationship equations were determined for each sex and combined using exponential equation (Figure I, II. and III). For Male fish,  $Weight = 101.8 - 12.89length$ ;  $R^2 = 0.887$ ; Female fish,  $Weight = 129.0 - 15.29length$ ,  $R^2 = 0.939$  while Combine Sexes of fish,  $Weight = 110.6 - 13.72length$ ;  $R^2 = 0.904$ . The agreement between the empirical weight and computed weight from regression can be termed as ideal growth for positive allometry since all the b value were higher than 3. The relationship between the gut length and fish length for Female is  $GTL = 41.006 + 1.242FSL$ ,  $R^2 = 0.3282$ ; Male is  $GTL = 31.786 + 1.679FSL$ ,  $R^2 = 0.7162$  and Combine is  $GTL = 36.796 + 1.4555FSL$ ,  $R^2 = 0.5165$ . The weight of the gut showed no variation because the fish eats the same composition of diet in the wild. This is in agreement with the report of Karachle and Stergiou (2010).



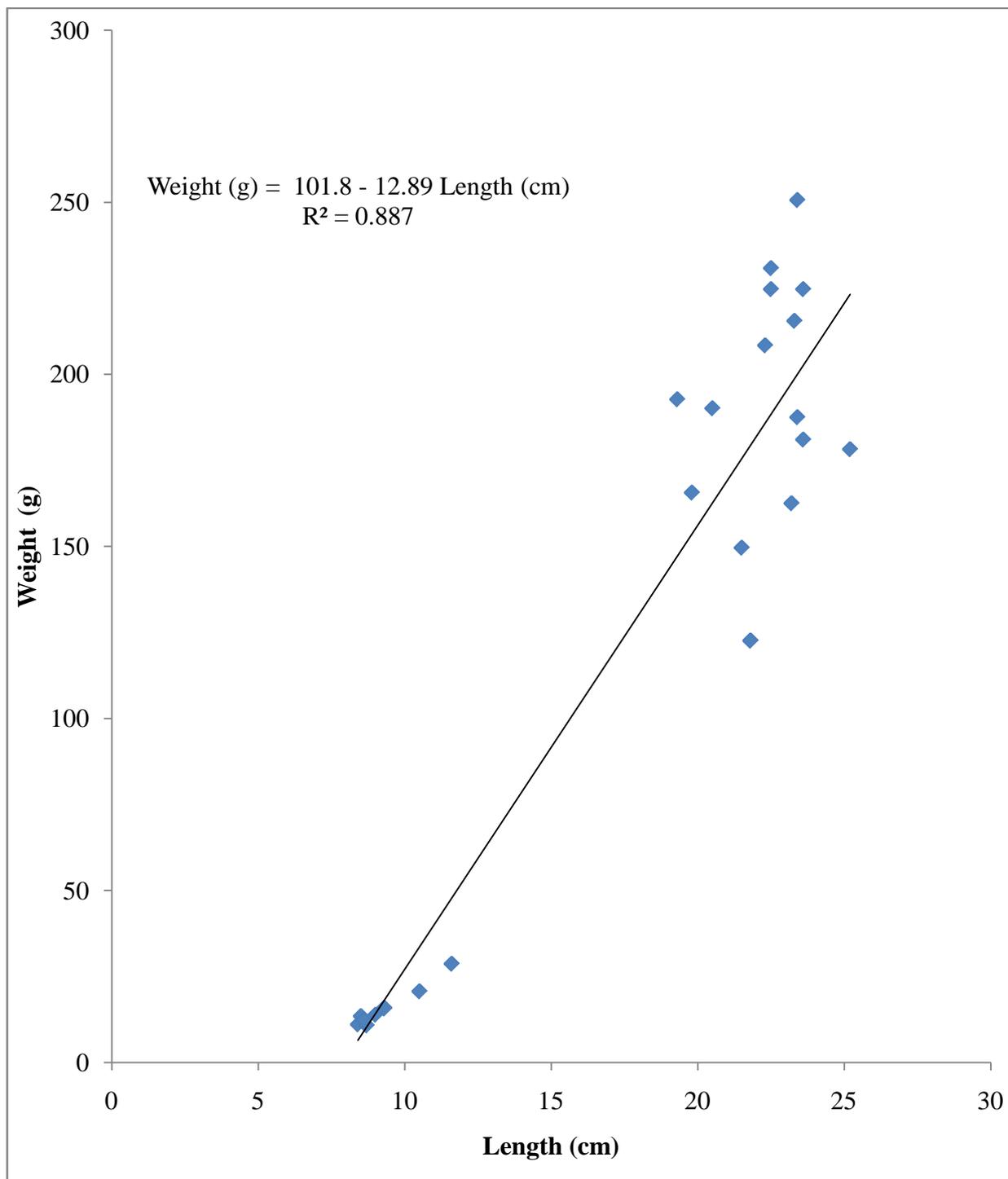


Figure 1: Length-Weight relationship of male *Oreochromis niloticus* from Wudil River

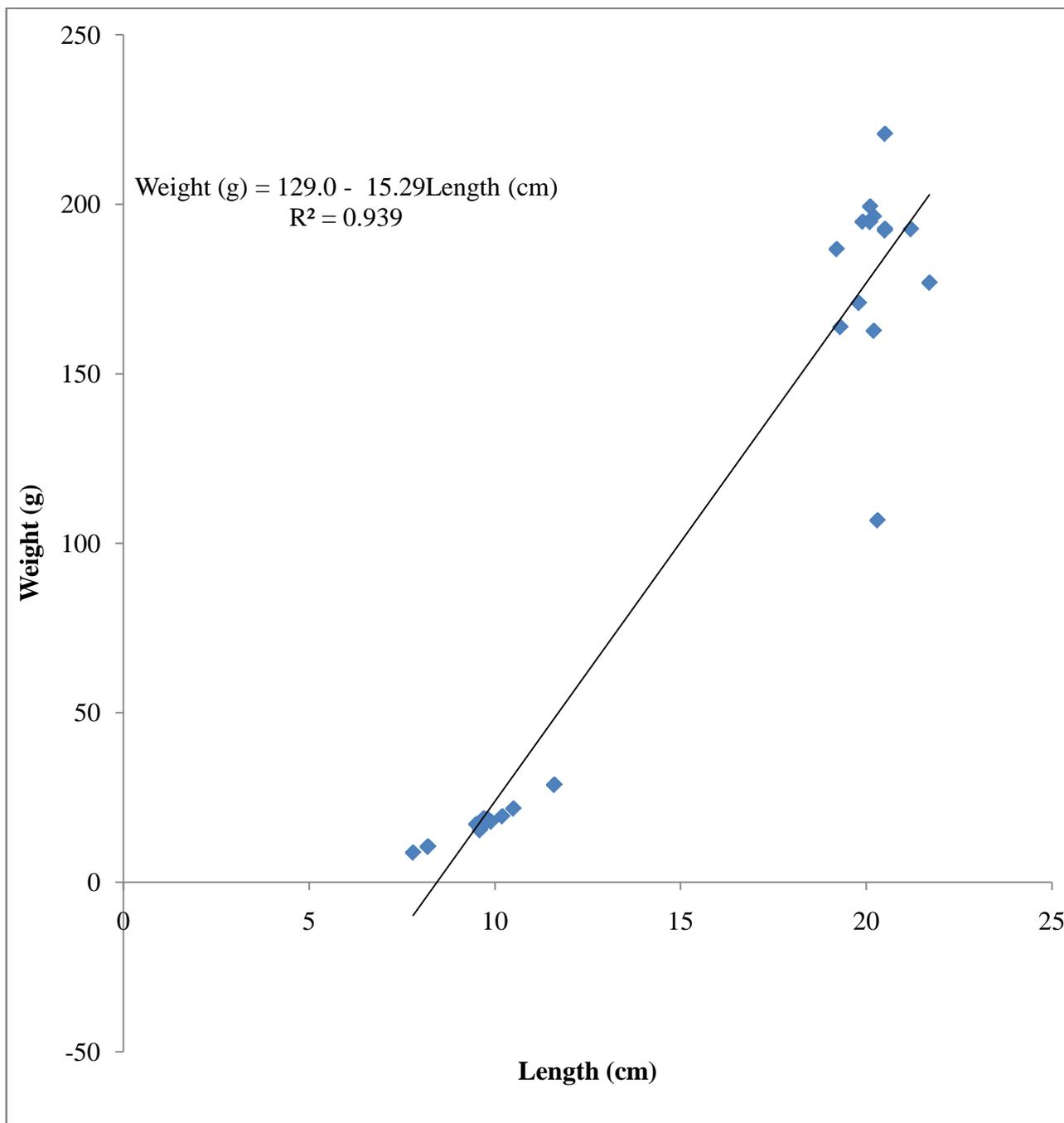


Figure 2: Length-Weight Relationship of Female *Oreochromis niloticus* from Wudil River

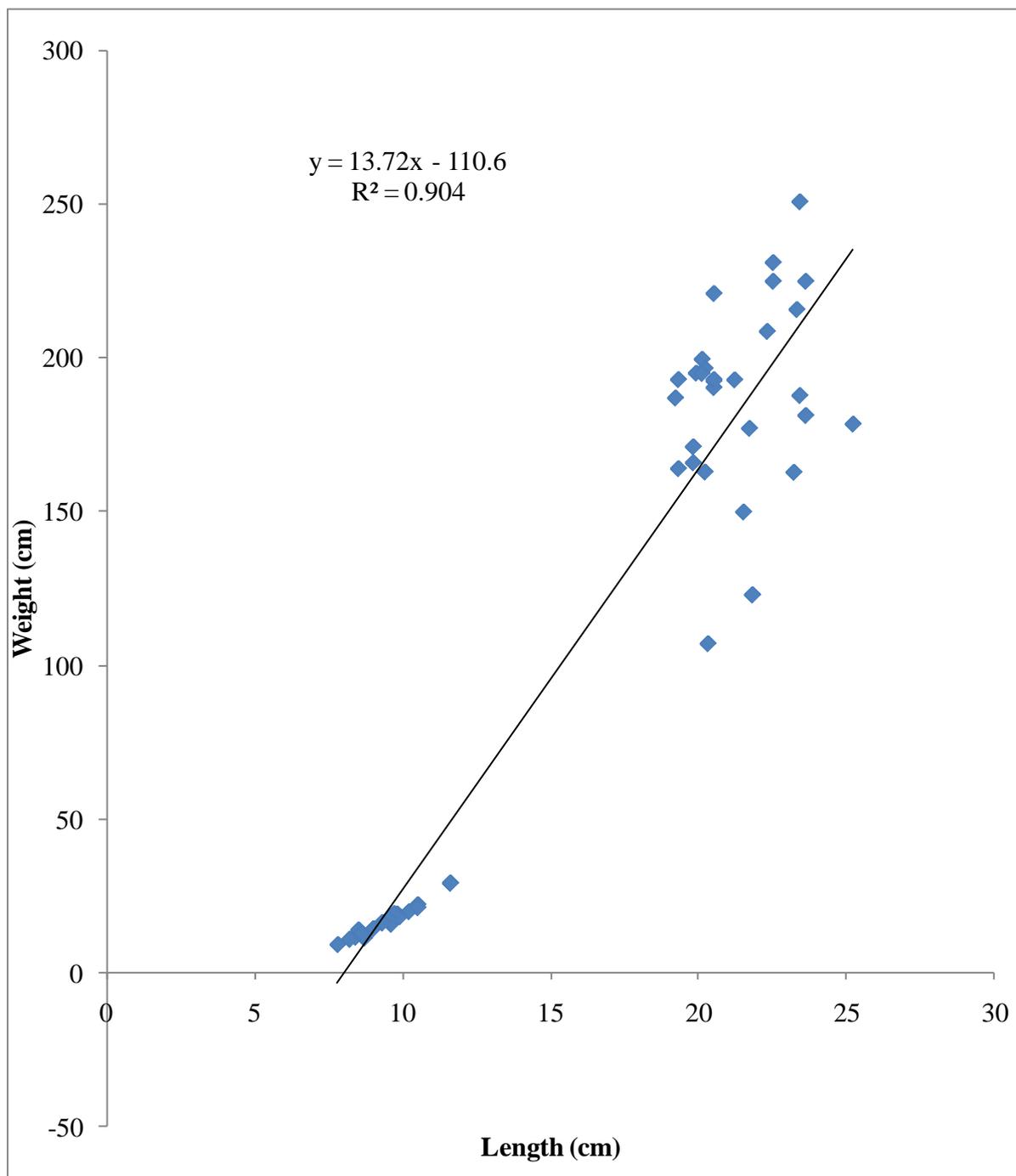


Figure 3: Length-Weight Relationship of Combine Sexes of *Oreochromis niloticus* in Wudil River

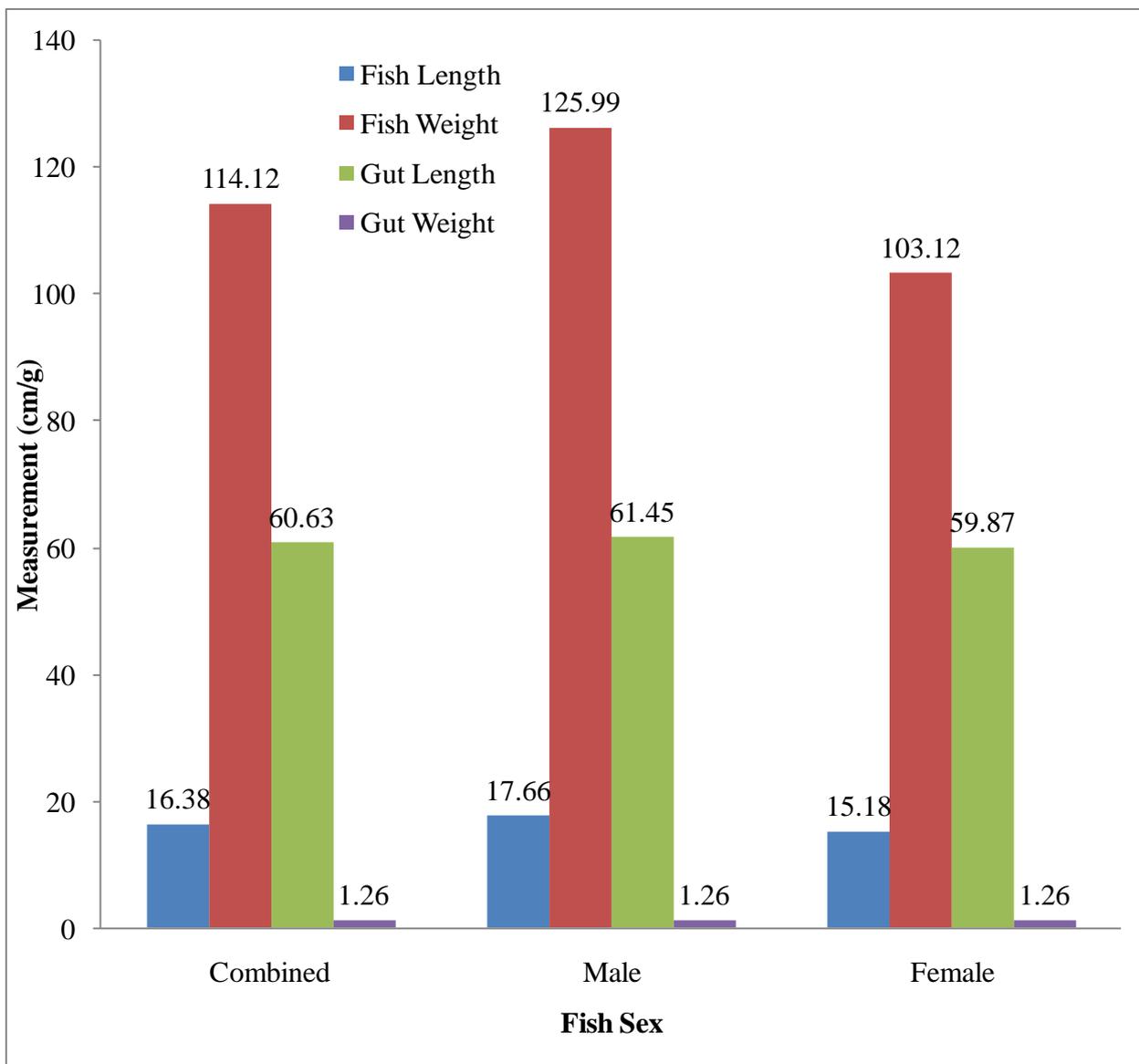


Figure 4: Fish and Gut length and Weight of *Oreochromis niloticus* from Wudil River

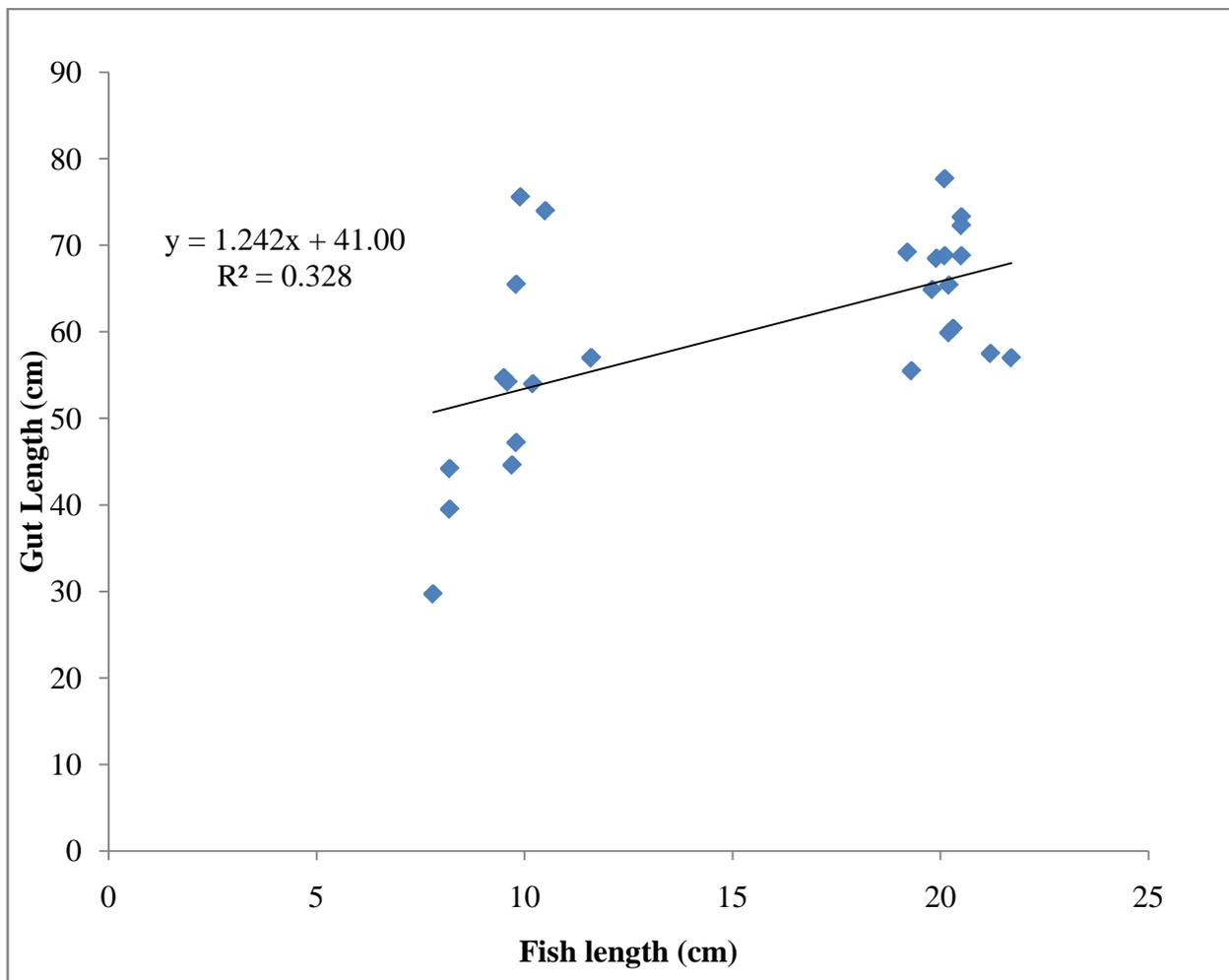


Figure 5: Gut length - Fish length relationship of female *Oreochromis niloticus* in Wudil River

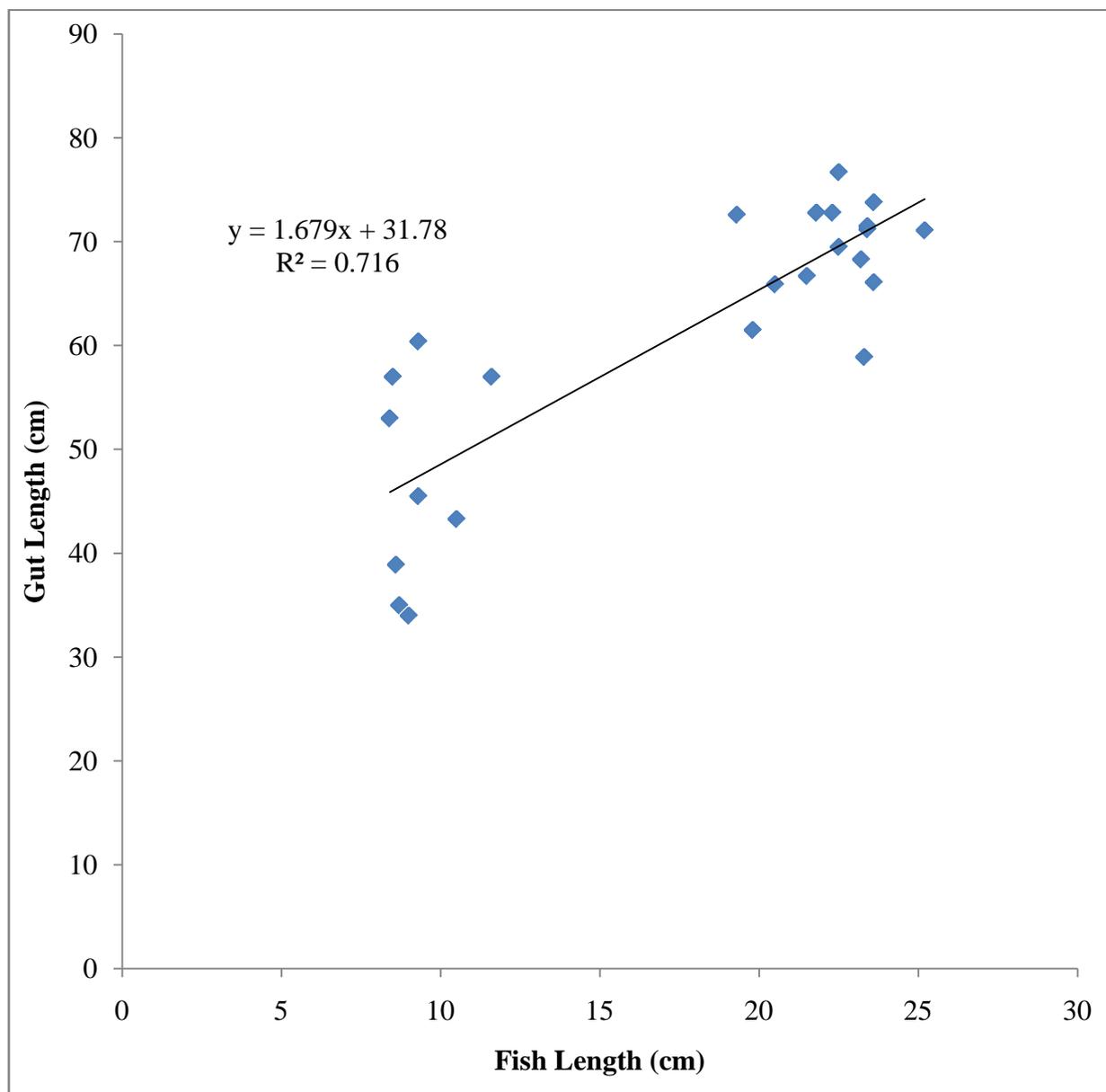


Figure 6: Gut length -Fish Length relationship of Male *Oreochromis niloticus* in Wudil River

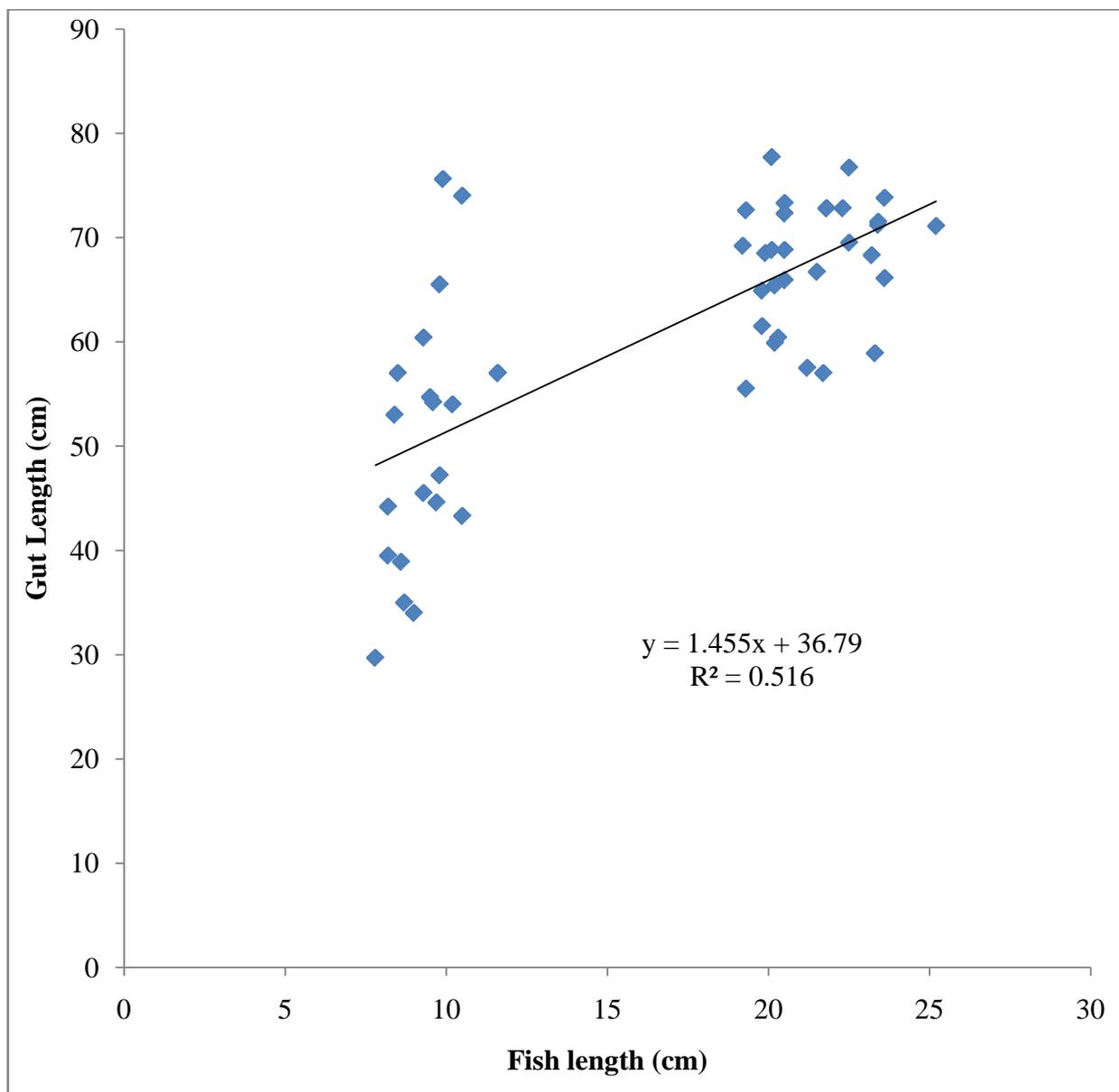


Figure 7: Gut-length - Fish length relationship of combine *Oreochromis niloticus* in Wudil River

Table 1: Mean Standard length, weight condition factor of *Oreochromis niloticus* from Wudil River, Kano state.

Parameters	<i>Oreochromis niloticus</i>		
	Male	Female	Combine
Mean Fish Standard length (cm)	17.66 <sup>a</sup>	15.18 <sup>a</sup>	16.38 <sup>a</sup>
Mean Fish Total weight (g)	125.99 <sup>a</sup>	103.12 <sup>c</sup>	114.12 <sup>b</sup>
Mean Condition factor (k)	2.2875 <sup>c</sup>	2.9480 <sup>a</sup>	2.5967 <sup>b</sup>
Mean Gut length (cm)	61.45 <sup>a</sup>	59.87 <sup>a</sup>	60.63 <sup>a</sup>
Mean Gut weight (g)	1.26 <sup>a</sup>	1.26 <sup>a</sup>	1.26 <sup>a</sup>

Mean of data with different superscripts are significantly different ( $p < 0.05$ )

## X. SUMMARY, CONCLUSION AND RECOMMENDATION

### a) Summary

The present study was conducted to determine the length - weight relationship and feeding habit of *O. niloticus* in Wudil River, Kano. Olurin and Aderibigbe (2006) calculated the length and weight and condition factor of pond reared Juvenile *O. niloticus*, with a view to determining whether the fishes are in good condition. Edah Bernard *et al.*, 2010) computed the wet weight - dry weight relationship of *O. niloticus* (Tilapia) insignificant relationship were found in all cases at 0.05 per cent with correlation coefficients for males, females and pooled sexes at 0.9241, 0.9632 and 0.9586 respectively and result of this study were not far from this high values as indicated on figure 1, 2, and 3. A number of factors (e.g. sex, seasons, environmental conditions, stress, and availability of food) also affect the condition of fish. Stewart (1988) observed stress as a result of the reduction in the breeding and nursery ground of *O. niloticus* in Lake Turkana, Kenya, as contributing to dramatically lower condition factors.

## XI. CONCLUSION

Length - weight regression analysis showing that the value of male, female and both sex exhibited allometric growth. There was significantly high correlation at 5% between the length and weight of both sexes. The condition factor indicated that the fish where stable conditions during the time of conducting the research and the gut length to fish length showed low correlation in female ( $R^2=0.3282$ ) and high in Male,  $R^2=0.7162$

### Recommendations

It is recommended that the condition factor of *Oreochromis niloticus* in the river is good for their wellbeing.

Fisheries management should be enhanced for higher productivity of *Oreochromis niloticus*.

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## Ensure the Stability of the Processing Depth of Machine for Hiding Pomegranate Bushes

By EE Abdunazarov & AR Rasuljonov

**Abstract-** This paper presents the results of experimental studies on the depth of processing of the vertical distance from the base plane of the machine burying the pomegranate bushes to the lower tie point of the hanging device and its effect on one plane. It was determined from the conditions of the depth of sinking of the hulls and stable operation at the specified depth, the formation of soil piles of the shape and height required for burying pomegranate bushes, providing the specified transport gap and low energy consumption. Experimental studies have shown that the vertical distance from the base plane of the machine to the lower attachment point of the hanging device should be 75-80 cm in order to sink the machine bodies that cover the pomegranate bushes to the specified depth, to operate stably at this depth and to provide the required transport clearance.

**Keywords:** *machine for hiding pomegranate bushes, plough body, instantaneous center of rotation, conditional thrust line, the hitch mechanism of the tractor, specified depth of immersion of plough bodies in soil, angle of inclination of the conditional thrust line to the horizon.*

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# Ensure the Stability of the Processing Depth of Machine for Hiding Pomegranate Bushes

EE Abdunazarov <sup>α</sup> & AR Rasuljonov <sup>σ</sup>

**Abstract-** This paper presents the results of experimental studies on the depth of processing of the vertical distance from the base plane of the machine burying the pomegranate bushes to the lower tie point of the hanging device and its effect on one plane. It was determined from the conditions of the depth of sinking of the hulls and stable operation at the specified depth, the formation of soil piles of the shape and height required for burying pomegranate bushes, providing the specified transport gap and low energy consumption. Experimental studies have shown that the vertical distance from the base plane of the machine to the lower attachment point of the hanging device should be 75-80 cm in order to sink the machine bodies that cover the pomegranate bushes to the specified depth, to operate stably at this depth and to provide the required transport clearance.

**Keywords:** machine for hiding pomegranate bushes, plough body, instantaneous center of rotation, conditional thrust line, the hitch mechanism of the tractor, specified depth of immersion of plough bodies in soil, angle of inclination of the conditional thrust line to the horizon.

## I. INTRODUCTION

In order to prevent frostbite in Uzbekistan, pomegranate bushes are buried in late autumn and opened in spring [1-7]. However, due to the lack of special equipment, the burial and opening of pomegranate bushes is not mechanized and is still done by hand. This, in turn, leads to increased labor and other costs and reduced productivity, and has a negative impact on pomegranate cultivation, high yields, and the establishment of largescale pomegranate plantations. It should also be noted that, given that pomegranate bushes are buried in late autumn, it is not possible to completely bury pomegranate bushes in all areas by hand in the early winter, and as a result, they are subject to cold blowing. Based on the above, our institute has developed a machine for burying pomegranate bushes in the ground, and research is being conducted to substantiate its parameters [8-16].

## II. METHOD

The machine consists of frame (Fig. 1) and a coupler mounted on it, followed by grooved transmissions, bearings and burying bodies, which are hung on the tractor.

In the process, the branches of the pomegranate bushes are compacted (compacted) and passed to the transmitters, which further compact and press the pomegranate bushes and direct them to the beds, which prepare the pomegranate bushes for burial by pressing them to the ground. As a result, one row of pomegranate bushes is completely buried in one pass of the unit, and their burial is fully mechanized.

Experimental studies were conducted to study the processing depth of the vertical distance from the base plane of the machine burying the pomegranate bushes to the lower tie point of the hanging device and its effect on one plane.

In the experiments, the distance between the upper and lower tie points of the machine suspension device did not change and was assumed to be 70 cm [17], The vertical distance from the base plane of the machine to the lower tie point of the suspension was changed every 55 cm from 55 cm to 85 cm. This was achieved by pushing the fingers of the hanging device down or up on its brackets (Fig. 2).

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Figure 2: Machine for hiding pomegranate bushes



Figure 2: Universal mounted construction

During the experiments, the working depth was set at 36 cm, the transverse distance between the housings was 200 cm, the height of the working surface of the enclosure was 68 cm and the speed of the unit was 5 and 7 km/h. The depth of machining and its standard deviation were taken as the main indicators, and in addition the gravitational resistance of the device was studied.

The results of the experiments are presented in Table 1, Figures 3 and 4. Their analysis shows that the machining depth increased with increasing vertical

distance from the base plane of the device to the lower tie point of the hanging device, while its standard deviation decreased, that is the stability of the machining depth improved.

However, in this case, the rates of increase in machining depth and decrease in mean square deviation decreased with increasing vertical distance from the machine base plane to the lower tie point of the hanging device.

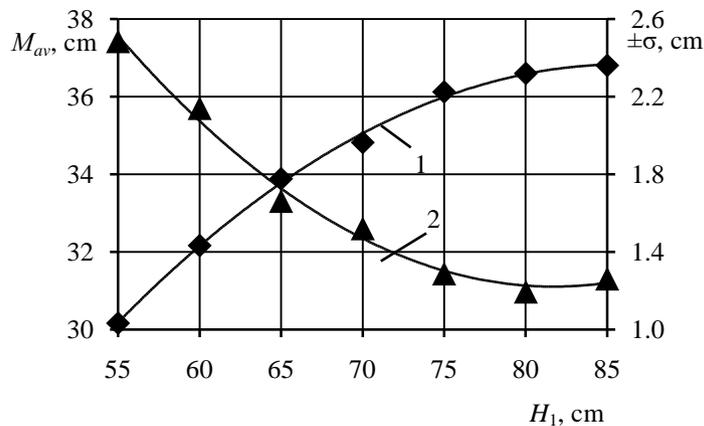
Table 1: The effect of the vertical distance ( $H_1$ ) from the base plane of the device to the lower tie point of the hanging device on the processing depth

The vertical distance from the base plane of the machine to the lower tie point of the hanging device , cm	Processing depth, cm		Weigh the car resistance , kN
	$M_{av}$	$\pm\sigma$	
V=5 km/h			
55	31,2	2,39	18,2
60	32,8	2,07	18,8
65	34,5	1,64	19,5
70	35,6	1,46	20,1
75	36,5	1,21	20,7
80	36,8	1,14	21,1
85	37,1	1,22	21,7
V=7 km/h			
55	30,1	2,48	18,8
60	32,1	2,14	19,4
65	33,8	1,66	19,9
70	34,8	1,52	20,5
75	36,1	1,28	20,9
80	36,6	1,19	21,7
85	36,8	1,26	22,1

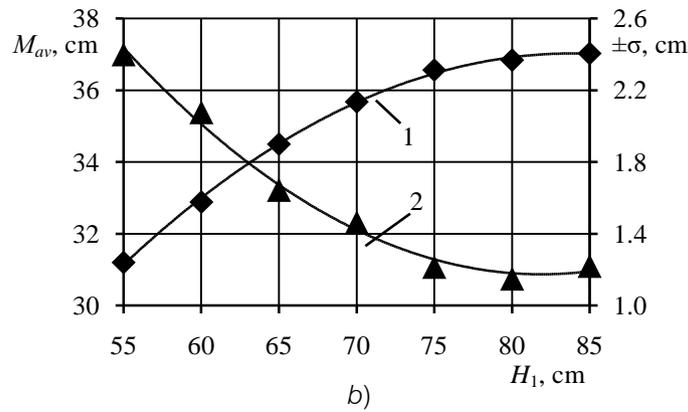
### III. RESULTS AND DISCUSSIONS

When this distance was less than 75 cm, the machine bodies did not sink to the specified depth, that is, the machining depth was less than the specified 36 cm, and when 75 cm and more, the machine bodies sunk to the specified depth. Therefore, when the vertical

distance from the base plane of the machine to the lower tie point of the suspension device increases from 55 cm to 85 cm, the machining depth at speeds of 5 and 7 km/h increases from 31.20 cm to 37.02 cm, 30.16 cm to 36, respectively. Increased to 80 cm, and its mean square deviation decreased from  $\pm 2.39$  cm to  $\pm 1.22$  cm, and from  $\pm 2.48$  cm to  $\pm 1.26$  cm.



a)



1.  $M_{av}=f(H_1)$ ; 2.  $\pm\sigma=f(H_1)$

a, b – 5 and 7 km/h respectively movement velocity

Figure 3: The effect of the vertical distance from the base plane of the machine to the lower tie point of the hanging device on the machining depth ( $M_{av}$ ) and its standard deviation ( $\pm\sigma$ )

From this it can be concluded that in order for the machine to sink to the specified depth and operate stably at that depth, the vertical distance from its base plane to the lower tie point of the suspension must be at least 75 cm.

from the base plane of the machine to the lower tie point of the suspension device is more than 80 cm.

The smallest squares method of graphical connections described in Figure 3 [18-21] can be expressed by the following empirical formulas defined by:

However, the required transport clearance of the machine is not provided when the vertical distance

a) For a case where the unit speed is 5 km/h

$$a = 12,887 - 0,286H_1 + 0,0017H_1^2, \text{ cm} \quad (r_k^2 = 0,9914); \quad (1)$$

$$\pm\sigma = - 12,594 + 1,1827H_1 - 0,007H_1^2, \text{ cm} \quad (r_k^2 = 0,9989). \quad (2)$$

b) For a case where the unit speed is 7 km / h

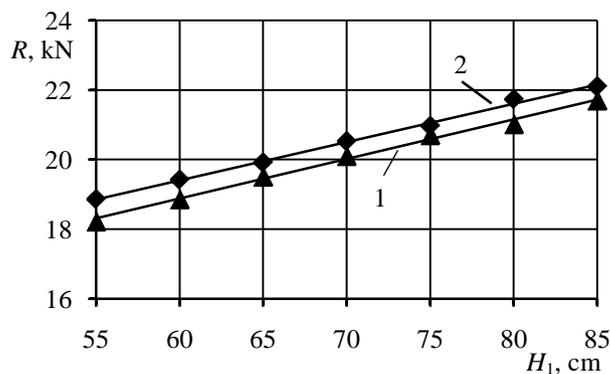
$$a = 13,312 - 0,296H_1 + 0,0018H_1^2, \text{ cm} \quad (r_k^2 = 0,9905); \quad (3)$$

$$\pm\sigma = - 14,254 + 1,187H_1 - 0,0069H_1^2, \text{ cm} \quad (r_k^2 = 0,9977). \quad (4)$$

where  $H_1$ - is the bottom of the suspension from the base plane of the machine vertical distance to the tie points (in the range of  $H_1 = 55$ -85 cm).

suspension from 55 cm to 85 cm increases its gravitational resistance at a speed of 5 km/h according to the law of straight lines from 18.2 kN to 21.7 kN, ie 3.5 kN, 7 km at an hourly rate of 18.8 kN to 22.1 kN, an increase of 3.3 kN (Figure 4).

An increase in the vertical distance from the base plane of the machine to the lower point of the



1 and 2 - the speed of the unit is 5 and 7 km / h, respectively

Figure 4: The graph of the change in traction resistance (R) of a machine depending on the vertical distance from its base plane to the lower tie point of the suspension device

#### IV. CONCLUSIONS

This means that the vertical distance from the base plane of the machine to the lower tie point of the suspension device should be 75-80 cm in order to ensure that the machine bodies that cover the pomegranate bushes sink to the specified depth, work stably at this depth and provide the required transport clearance.

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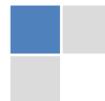
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## ACCESS TO EDITORIAL BOARD

### BECOME A MEMBER OF THE EDITORIAL BOARD

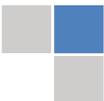
Fellows may join as a member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. Additionally, Fellows get a chance to nominate other members for Editorial Board.

Career Credibility Exclusive Reputation

## AND MUCH MORE

### GET ACCESS TO SCIENTIFIC MUSEUMS AND OBSERVATORIES ACROSS THE GLOBE

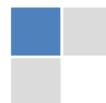
All members get access to 5 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 10 GB free secure cloud access for storing research files.



### ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL

ASSOCIATE OF SCIENCE FRONTIER RESEARCH COUNCIL is the membership of Global Journals awarded to individuals that the Open Association of Research Society judges to have made a 'substantial contribution to the improvement of computer science, technology, and electronics engineering.

The primary objective is to recognize the leaders in research and scientific fields of the current era with a global perspective and to create a channel between them and other researchers for better exposure and knowledge sharing. Members are most eminent scientists, engineers, and technologists from all across the world. Associate membership can later be promoted to Fellow Membership. Associates are elected for life through a peer review process on the basis of excellence in the respective domain. There is no limit on the number of new nominations made in any year. Each year, the Open Association of Research Society elect up to 12 new Associate Members.



## BENEFIT

### TO THE INSTITUTION

#### GET LETTER OF APPRECIATION

Global Journals sends a letter of appreciation of author to the Dean or CEO of the University or Company of which author is a part, signed by editor in chief or chief author.



### EXCLUSIVE NETWORK

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A ASFRC member gets access to a closed network of Tier 1 researchers and scientists with direct communication channel through our website. Associates can reach out to other members or researchers directly. They should also be open to reaching out by other.

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### CERTIFICATE

#### RECEIVE A PRINTED COPY OF A CERTIFICATE

Associates receive a printed copy of a certificate signed by our Chief Author that may be used for academic purposes and a personal recommendation letter to the dean of member's university.

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### DESIGNATION

#### GET HONORED TITLE OF MEMBERSHIP

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Career

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Career Credibility Reputation



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### ACCESS TO ALL THE PREMIUM TOOLS

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### ORGANIZE SEMINAR/CONFERENCE

Associates are authorized to organize symposium/seminar/conference on behalf of Global Journal Incorporation (USA). They can also participate in the same organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent. Additionally, they get free research conferences (and others) alerts.

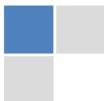
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## EARLY INVITATIONS

### EARLY INVITATIONS TO ALL THE SYMPOSIUMS, SEMINARS, CONFERENCES

All associates receive the early invitations to all the symposiums, seminars, conferences and webinars hosted by Global Journals in their subject.

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Associates can publish articles (limited) without any fees. Also, they can earn up to 30-40% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.

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Associate members are eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get a remuneration of 15% of author fees, taken from the author of a respective paper.

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## AND MUCH MORE

### GET ACCESS TO SCIENTIFIC MUSEUMS AND OBSERVATORIES ACROSS THE GLOBE

All members get access to 2 selected scientific museums and observatories across the globe. All researches published with Global Journals will be kept under deep archival facilities across regions for future protections and disaster recovery. They get 5 GB free secure cloud access for storing research files.



ASSOCIATE	FELLOW	RESEARCH GROUP	BASIC
<p>\$4800 lifetime designation</p> <hr/> <p>Certificate, LoR and Momento 2 discounted publishing/year Gradation of Research 10 research contacts/day 1 GB Cloud Storage GJ Community Access</p>	<p>\$6800 lifetime designation</p> <hr/> <p>Certificate, LoR and Momento Unlimited discounted publishing/year Gradation of Research Unlimited research contacts/day 5 GB Cloud Storage Online Presense Assistance GJ Community Access</p>	<p>\$12500.00 organizational</p> <hr/> <p>Certificates, LoRs and Momentos Unlimited free publishing/year Gradation of Research Unlimited research contacts/day Unlimited Cloud Storage Online Presense Assistance GJ Community Access</p>	<p>APC per article</p> <hr/> <p>GJ Community Access</p>



# PREFERRED AUTHOR GUIDELINES

**We accept the manuscript submissions in any standard (generic) format.**

We typeset manuscripts using advanced typesetting tools like Adobe In Design, CorelDraw, TeXnicCenter, and TeXStudio. We usually recommend authors submit their research using any standard format they are comfortable with, and let Global Journals do the rest.

Alternatively, you can download our basic template from <https://globaljournals.org/Template.zip>

Authors should submit their complete paper/article, including text illustrations, graphics, conclusions, artwork, and tables. Authors who are not able to submit manuscript using the form above can email the manuscript department at [submit@globaljournals.org](mailto:submit@globaljournals.org) or get in touch with [chiefeditor@globaljournals.org](mailto:chiefeditor@globaljournals.org) if they wish to send the abstract before submission.

## BEFORE AND DURING SUBMISSION

Authors must ensure the information provided during the submission of a paper is authentic. Please go through the following checklist before submitting:

1. Authors must go through the complete author guideline and understand and *agree to Global Journals' ethics and code of conduct*, along with author responsibilities.
2. Authors must accept the privacy policy, terms, and conditions of Global Journals.
3. Ensure corresponding author's email address and postal address are accurate and reachable.
4. Manuscript to be submitted must include keywords, an abstract, a paper title, co-author(s) names and details (email address, name, phone number, and institution), figures and illustrations in vector format including appropriate captions, tables, including titles and footnotes, a conclusion, results, acknowledgments and references.
5. Authors should submit paper in a ZIP archive if any supplementary files are required along with the paper.
6. Proper permissions must be acquired for the use of any copyrighted material.
7. Manuscript submitted *must not have been submitted or published elsewhere* and all authors must be aware of the submission.

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It is required for authors to declare all financial, institutional, and personal relationships with other individuals and organizations that could influence (bias) their research.

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Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

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- Ideas
- Findings
- Writings
- Diagrams
- Graphs
- Illustrations
- Lectures



- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

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2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

### Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

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### Appealing Decisions

Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

### Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

### Declaration of funding sources

Global Journals is in partnership with various universities, laboratories, and other institutions worldwide in the research domain. Authors are requested to disclose their source of funding during every stage of their research, such as making analysis, performing laboratory operations, computing data, and using institutional resources, from writing an article to its submission. This will also help authors to get reimbursements by requesting an open access publication letter from Global Journals and submitting to the respective funding source.

## PREPARING YOUR MANUSCRIPT

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.



### ***Manuscript Style Instruction (Optional)***

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

### ***Structure and Format of Manuscript***

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

- a) A title which should be relevant to the theme of the paper.
- b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
- c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
- d) An introduction, giving fundamental background objectives.
- e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
- f) Results which should be presented concisely by well-designed tables and figures.
- g) Suitable statistical data should also be given.
- h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

- i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
- j) There should be brief acknowledgments.
- k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.



## FORMAT STRUCTURE

***It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.***

All manuscripts submitted to Global Journals should include:

### **Title**

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

### **Author details**

The full postal address of any related author(s) must be specified.

### **Abstract**

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

### **Keywords**

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in a research paper?" Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

### **Numerical Methods**

Numerical methods used should be transparent and, where appropriate, supported by references.

### **Abbreviations**

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

### **Formulas and equations**

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

### **Tables, Figures, and Figure Legends**

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.



## Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

## PREPARATION OF ELETRONIC FIGURES FOR PUBLICATION

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

## TIPS FOR WRITING A GOOD QUALITY SCIENCE FRONTIER RESEARCH PAPER

Techniques for writing a good quality Science Frontier Research paper:

**1. Choosing the topic:** In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

**2. Think like evaluators:** If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

**3. Ask your guides:** If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

**4. Use of computer is recommended:** As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

**5. Use the internet for help:** An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.



**6. Bookmarks are useful:** When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

**7. Revise what you wrote:** When you write anything, always read it, summarize it, and then finalize it.

**8. Make every effort:** Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

**9. Produce good diagrams of your own:** Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

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**11. Pick a good study spot:** Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

**12. Know what you know:** Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

**13. Use good grammar:** Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

**14. Arrangement of information:** Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

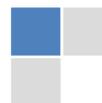
**15. Never start at the last minute:** Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

**16. Multitasking in research is not good:** Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

**17. Never copy others' work:** Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

**18. Go to seminars:** Attend seminars if the topic is relevant to your research area. Utilize all your resources.

**19. Refresh your mind after intervals:** Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.



**20. Think technically:** Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

**21. Adding unnecessary information:** Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

**22. Report concluded results:** Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

**23. Upon conclusion:** Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium through which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

## INFORMAL GUIDELINES OF RESEARCH PAPER WRITING

### **Key points to remember:**

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

### **Final points:**

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

*The introduction:* This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

### **The discussion section:**

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

### **General style:**

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

**To make a paper clear:** Adhere to recommended page limits.



### *Mistakes to avoid:*

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

### **Title page:**

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

**Abstract:** This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

*Reason for writing the article—theory, overall issue, purpose.*

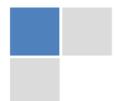
- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

### **Approach:**

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

### **Introduction:**

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.



*The following approach can create a valuable beginning:*

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

#### **Approach:**

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

#### **Procedures (methods and materials):**

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

#### **Materials:**

*Materials may be reported in part of a section or else they may be recognized along with your measures.*

#### **Methods:**

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

#### **Approach:**

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

#### **What to keep away from:**

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.



**Results:**

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

**Content:**

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

**What to stay away from:**

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

**Approach:**

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

**Figures and tables:**

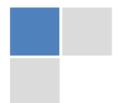
If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

**Discussion:**

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."



Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

**Approach:**

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

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<i>Introduction</i>	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
<i>Methods and Procedures</i>	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
<i>Result</i>	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
<i>Discussion</i>	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
<i>References</i>	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



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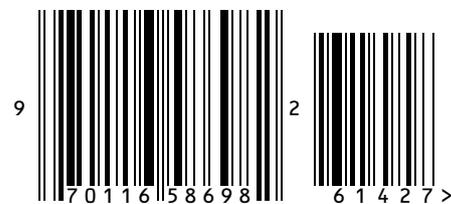


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