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QUANTIFICATION DE LA SENSIBILITÉ DE LA RIZICULTURE PLUVIALE AU STRESS HYDRIQUE DANS LE CONTEXTE AGRO ÉCOLOGIQUE DE LUBUMBASHI [QUANTIFICATION OF PLUVIAL RICE CULTURE SENSITIVITY TO HYDRIC STRESS IN THE OF LUBUMBASHI AGROECOLOGY]

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RESUME

Ce présent travail a été entrepris pour évaluer les effets de la date de semis et de la matière organique sur la croissance du riz pluvial (Oryva sativa) dans la perspective de formuler des recommandations pour l'utilisation de la matière organique dans la fertilisation en riziculture pluviale d'une part et proposer la meilleure période de semis dans la région de Lubumbashi et en zone à faible pluviométrie d'autre part.

L'essai a été installé suivant un dispositif factoriel en 3 répétitions comprenant 4 dates de semis et 4 doses de la fiente de poules. Les observations ont porté sur quelques paramètres de croissance et le besoin d'eau d'irrigation de la culture.

Les résultats obtenus montrent que, seule la date de semis a eu une influence significative sur tous les paramètres de croissance étudiés alors que les interactions entre la date de semis et la fiente des poules ne les ont pas influencés significativement. Il en est de même de l'application, seule, de la fiente des poules pour laquelle l'effet est non significatif. Le déficit hydrique croît de façon linéaire avec le nombre des jours du retard encouru dans le semis du riz.

Mots clés : riziculture pluviale, date semis, fiente poules.

ABSTRACT

This work was undertaken to assess the effects of sowing and chicken droppings on the growth of rainfed rice (*Oryva sativa*) with a view to making recommendations for the use of chicken droppings in rice fertilization On the one hand, and propose the best sowing period in the Lubumbashi region and in the low rainfall zone.
The test was set up using a 3-fold factorial system comprising 4 sowing dates of rice and 4 doses of chicken droppings. Observations were made on some growth parameters and on the need for irrigation water from rainfed rice crops.
The results show that only the sowing date had a significant influence on all the growth parameters studied, whereas the interactions between the sowing date and the hen droppings did not influence them significantly. The same applies to the application, alone, of chicken droppings for which the effect is insignificant. Water deficit increases linearly with the number of days of delay in sowing rice.

Key words: rainfed rice , cultivation,sowing date, chicken, droppings.

1. INTRODUCTION

Rice is the staple food for the vast majority of the world's population. It provides about 70% of the calories needed for food in Asia and the United States for African and South American populations [1].

Rainfed rice (Oryza sativa L.) is grown on unsaturated soil without irrigation water. But, in fact, irregular rainfall and low water supply, mediocre and highly variable variables are never tolerated by drought [2]. While almost 50% of the world's cultivated soils have low water availability. Even in tropical areas where rainfall averages 2600 mm of water annually, the sun's water supply can drop sharply during the dry season and vegetation growth [4].

Tropical agriculture faces a number of constraints among the low level of soil fertility, the low level of agricultural inputs, the low level of technology and inappropriate agro-technical practices.

In addition to these rather technical-economic constraints, there is another natural, of course, the rainfall deficit. To overcome this progressive rainfall deficit, they are not only sources of nutrients for plants, but also regulators of the hydric regime and improving fertility, because they strongly reduce the solidity of the links between water and soil particles [5]. Especially in rainfed rice cultivation which is practiced in plateaux region or on slopes of hills [5].

The object of this study is evaluating the effect of humus improvements on rice resistance to hydric stress on the basis of growing periods and the doses of growth of chicken droppings.

2. ENVIRONMENT, MATERIAL AND METHODS

2.1. ENVIRONMENT

The experiment was carried out in Lubumbashi, Haut-Katanga (DRC), justly at the center of agronomic research CRAA in acronym, whose geographical coordinates are as follows: 27 ° 48'61 " East, 11 ° 61 ' 55 3 " from the south latitude and 1257m above sea level.

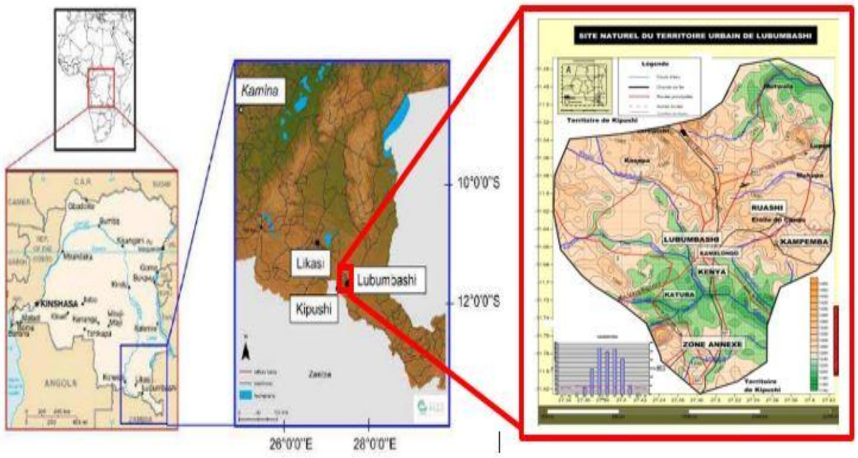

Fig I. Map of the city of Lubumbashi

Annual rainfall is around 1270mm with a minimum of 717 and a maximum of 1770mm [6].

The typical climatic conditions of the region are defined by two distinct seasons during the year. This is the dry and cold season (May to September) and the rainy season and hot (October to April). From the point of view of the regional climate, Lubumbashi and its surroundings are characterized by an average rainfall of 1100 mm and the annual average rainfall is "estimated at 1240 mm.

Table I. Climatic data for the period from 10/12/2017 to 31/05/2017

Climatic period and climatic parameters		**2016**	**2017**				
		December	**January**	**February**	**March**	**April**	**May**
Precipitation	quantity (mm)	159	181,3	399,4	139,5	207,8	34,4
	Nomber of rainy days	16	18	22	13	8	5
Temperature (°C)	Maximum	26,6	25,07	24,6	24,5	24,8	25,9
	Average	22	21,3	20,9	20,6	20,5	18,7
	Minimum	17,4	17,2	17,3	16,71	16,2	11,5
Relative humidity (%)		79	85	87	87	85	64

Source: National Meteorological and Remote Sensing Satellite Agency (METTELSAT) / Luano Station.

Table I. shows that the temperature conditions prevailing during the test were generally satisfactory for the normal development of rainfed rice. Indeed, monthly temperature averages varied between 21.44 ° C (December) and 18.7 ° C (May), which is close to the 35-37 ° C average required for optimal growth and development culture.

2.2. MATERIAL

To materialize this study, hen droppings were used as organic matter and came from a poultry house in the CRAA district. It was chosen for its ability to retain the moisture necessary for plant growth [7]. While rice (Oryza sativa) of the variety NERICA served as a test plant.

2.3. METHOD

The test was conducted according to a factorial device comprising three repetitions. The main factor included the sowing date of rice, consisting of four different seeding periods at the 7-day interval: D1: sowing as of 13/12/2016; D2: sowing as of 20/12/2016; D3: sowing on 27/12/2016 and D4: sowing as of 04/01/2017. After manual plowing to the hoe at a depth of 25cm, the field was limited to 21m x 14.5m divided into 4 blocks each comprising 12 plots of 2m side. The grains of the rice were sown at the intervals of 20cmx 20cm at the rate of three grains per poquet carried out on 48 elementary plots, these parcels are spaced some

another 0.5 m and spacing between the blocks was 1 m. Each parcel contains 300 seedlings at the beginning, an area of about 2 m2.

The secondary factor is the application of chicken droppings with four levels; (F0: 0 Kg.ha-1 of droppings), F1: 2500 Kg.ha-1 droppings; F2: 5000 Kg.ha-1 droppings and F3: 7500 Kg.ha-1 of droppings.

In the course of the vegetation, the germination rate, the height of the plants, the number of tillers, the height of the plants during the heading period and the weight of the biomass were determined.

The data from the observations made on the parameters studied were entered using an Excel program. Descriptive statistics included averages and deviations around these quantitatively measured parameter means. Statistical inference was based on a two-factor analysis of variance using the Minitab 16 software, which tested the effects of the date of grain sowing of rice and the contribution of hen dung to behavior. seedlings and to which the ad-hoc Tukey multiple comparisons test at the 5% threshold in order to identify which were significantly different. The regression test was done to determine the relationship between the biomass of rice plants and the level of known water stress.

The level of water stress experienced by rice cultivation was determined using the FAO Cropwat 8.0 software. Its estimate is related to the need for irrigation water that has been calculated by successively including: the calculation of potential evapotranspiration, effective rainfall, crop characteristics and soil characteristics

Raising rate, height and number of panicles of rice plant

The results of the observations made on the growth parameters relating specifically to the emergence rate, plant height and the number of panicles of rice plants are presented in Table II below. It shows that the highest emergence rate, of the order of 46%, was observed in (D3), followed by that of 36% achieved in (D4), then comes that of 28% obtained in (D1).) and a poor emergence rate of 21% was observed in (D2).

The lowest height is 14 cm obtained in (D3), followed by that of 15 cm made in (D1), then comes the 17 cm obtained in (D4). Compared with (D2) where high-height plants are recorded with a high value of 18 cm respectively. In addition, a large panicle number of about 2 panicles per plant was observed (D4), whereas sowing in (D1) was associated with a reduction compared to this one with a number of 1 panicle per plant, comes consequently a number of 1 panicle date of 20/12/2016 (1 ± 1b) (D2), and finally in (D4) where one records a number of panicle more and more close to the second date of sowing with (1 ± 1b).

Table II. Influence of sowing date and manure on vegetative growth of rice.
Mean ± standard deviation. The different letters indicate significant differences after comparison with the HSD (0.05)

Treatment		**Rate of emergence (%)**	**Height of plant (cm)**	**Number of panicles**
D1	F0	35±10	15,2±3	1±0
	F1	28±14	17±3,4	1±1
	F2	23±17	15±2	1±1
	F3	25±12	14,2±2	1±1
	Average	28±12	15±2,2ab	1±1b
D2	F0	26±10	17,2±2	1±0
	F1	19±4	18±2	2±1
	F2	21±11	17,1±6	1 ±0
	F3	18±9	19,2±4,2	1±1
	Mean	21± 8,	18±3,3a	1±1b
D3	F0	39± 10	11,2±2	0±0
	F1	53± 8	16±2	1± 2
	F2	41±12	15±3	1±1
	F3	52± 8	16 ±4,4	1±1
	Mean	46±11	14,3±3,2 b	1±1b
D4	F0	35± 5	16,3±2	2±0
	F1	39± 3	17,3±2	2±1
	F2	34±7	17±2	2±2
	F3	36±11	18,1±4	3±0
	Mean	36±6	17,1±2,1ab	2±1a
Manure average	F0	34± 9	15±3	1±1
	F1	35±15	17±2,1	2±1
	F2	30±13	16±3	1±1
	F3	33±16	17±4	2±1
Date effect		0.0000	0.022	0.001
Manure effect		0.611	0.467	0.159
Interaction		0.648	0.91	0.751

Legend: D1: *sowing on 13/12/2016, D2: sowing on 20/12/2016, D3: sowing on 27/12/2016, sowing on 03/01/2017, F0: 0 t / ha of chicken droppings, F1: 2.5 t / ha of chicken droppings, F2: 5t / ha of chicken droppings, F3: 7.5 t / ha of chicken droppings.*

♣ **Number of leaves, height of plants and number of tillers during heading period of rice**

The results of the observations made on the growth parameters for number of leaves, the height of the plants and the number of tillers during the period of heading of the rice are presented in Table III below.

According to these results, the lowest number is 24 leaves per plant obtained on the third date of sowing (D3). On the other hand, the highest number was obtained in (D1), with respectively 71 leaves per plant, followed by 40 leaves per plant in (D4), then there were the order of 38 obtained on the second date is (D2).

The average heights according to the sowing dates vary from 21.4 to 41 cm. The result of the analysis of the variance reveals that the lowest heights are of the order of (21.4 ± 15.3b) obtained in (D3), whatever the level of fertilization applied, unlike the other dates of sowing where we register more. The first date of sowing (D1) resulted in large plants (41 cm), followed by sowing at the fourth sowing date (D4) with an average size of 34 cm and then followed by (D2) with respectively heights of (30 ± 11ab) cm associated with a reduction of 4 cm compared to this one. As for the number of tillers, it is observed that the number of tillers during the heading period in (D3) is (5 tillers / plant) is lower than that of the other three (7talles / plant at 20/12/2026 (D2), 8 tillers / plant at the fourth (D4) and the implant number is of the order of 16 tillers / plant obtained in (D1).

Table III. Influence of sowing date and manure on vegetative growth of rice.
Mean ± standard deviation. The different letters indicate significant differences after comparison with the HSD (0.05)

Treatment		**Number of leaves at heading**	**Heading height at heading heading**	**Number of tillers at heading**
D1	**F0**	**67±6**	**42,2± 5,2**	**16±4**
	F1	**62±13**	**33±11**	**14±3,3**
	F2	**77±33**	**49,4±16,4**	**19±10**
	F3	**75±9**	**40±4,2**	**16±4**
	Average	**71±17a**	**41±11a**	**16±5a**
D2	**F0**	**36±13**	**31±7**	**6±2**
	F1	**33±12**	**29±5,1**	**7±2**
	F2	**38±27**	**24±15,4**	**6±4**
	F3	**47±36**	**35±14,1**	**8±5**
	Average	**38±21b**	**30±11ab**	**7±3b**
D3	**F0**	**17±29**	**15,1± 19**	**4±6**
	F1	**32±3**	**30±3**	**8±2**
	F2	**30±26**	**25± 22**	**6±5**
	F3	**16±14**	**16,2±16**	**3±3**
	Average	**24±20b**	**21,4±15,3b**	**5±4b**
D4	**F0**	**35±20**	**36±2**	**7±3**
	F1	**34±4**	**27±7**	**8±2**
	F2	**40±19**	**36±3,1**	**7±3**
	F3	**53±16**	**38,4±3,4**	**10±6**
	Average	**40±16b**	**34,1±6a**	**8±3**
Average manure	**F0**	**39±26**	**31,1±14**	**8±6b**
	F1	**40±15**	**30±7**	**9±3**
	F2	**46±30**	**33,3±17,1**	**101±10**
	F3	**48±30**	**32±14**	**9±6**
Date effect		**0.000**	**0,002**	**0.000**
Manure effect		**0,692**	**0,873**	**0,856**
Interaction		**0,924**	**0,441**	**0,823**

Legend: D1: *sowing on 13/12/2016, D2: sowing on 20/12/2016, D3: sowing on 27/12/2016, sowing on 03/01/2017, F0: 0 t / ha of chicken droppings, F1: 2.5 t / ha of chicken droppings, F2: 5t / ha of chicken droppings, F3: 7.5 t / ha of chicken droppings. Fresh biomass of rained rice plant the results of the observations made on the biomass of seedlings of the rice culture are presented in Table IV below. The largest amount of fresh biomass is of the order 1833g obtained in (D1), followed by 1321g achieved in date (D4), third 850g of biomass achieved on the third date (D3). Finally the lowest fresh biomass is obtained on second date (D2).*

Table IV. Influence of sowing date and manure on fresh biomass of rice
Mean ± standard deviation. The different letters indicate significant differences after comparison with the HSD (0.05)

Treatment		Fresh Biomass **(g)**
D1	F0	2500±500
	F1	1733±252
	F2	2333±1528
	F3	1833±764
	Average	2100±838a
D2	F0	311±177
	F1	372±475
	F2	203±260
	F3	759±1076
	Average	411±564
D3	F0	500±707
	F1	1500±707
	F2	500±500
	F3	1000±866
	Average	850±709
D4	F0	1767±666
	F1	1017±775
	F2	1002±862
	F3	1500±500
	Mean	1321±697
Average Fum	F0	1339±1055
	F1	1124±735
	F2	1010±1159
	F3	1273±831
Effect of sowing date		0
Manure effect		NS
Interaction date-manure		NS

Legend: *D1: sowing on 13/12/2016, D2: sowing on 20/12/2016, D3: sowing on 27/12/2016, sowing on 03/01/2017, F0: 0 t / ha of chicken droppings, F1: 2.5 t / ha of chicken droppings, F2: 5t / ha of chicken droppings, F3: 7.5 t / ha of chicken droppings.*

Water deficit levels of rainfed rice at four sowing dates

♣ *Level of water deficit at the first date of sowing of rice*

From this result, it can be seen that the cultivation of rice sown on that date has had the overall level of 100 mm moisture stress throughout its life cycle, expressed in terms of the need for irrigation water. The most important irrigation needs are in the initial phase of cultivation in the second decade of December with 51mm per decade and in the late season in the first two decade of May (30 and 15.1mm by decade).

Table V. Levels of water deficit in the cultivation of sown rice as of 13/12/2016

Month	Decade	Phase	Kc	ETc	ETc	Rain eff.	Bes. Irr.
			Coeff	Day/mm	mm/dec	mm/dec	mm/dec
Dec	2	Init	1,09	3 ,14	31,4	44,5	51
Dec	3	Init	1,10	3,42	34,2	43,9	0,0
Jan	1	Init	1,10	3,08	30,8	41	0,0
Jan	2	Believe	1,10	2,98	29,8	41,7	0,0
Jan	3	Believe	1,12	3,26	32,6	46,1	0,0
Feb	1	Believe	1,13	2,96	29,6	53,9	0,0
Feb	2	Believe	1,15	3,26	32,6	59,4	0,0
Feb	3	Believe	1,16	2,96	29,6	51,6	0,0
Mach	1	Mid know	1,18	2,95	29,5	39,7	0,0
Mach	2	Mid know	1,18	2,96	29,6	32	0,0
Mach	3	Mid know	1,18	2,94	29,4	36,8	0,0
Apr	1	Mid know	1,18	2,85	28,5	47,2	0,0
Apr	2	Mid know	1,18	2,80	28,0	52,7	0,0
Apr	3	Arr know	1,09	3,19	31,9	38,7	0,0
May	1	Arr know	1,15	3,53	35,3	20,3	15,0
May	2	Arr know	1,11	3,75	37,5	7,4	30,1
May	3	Arr know	1,09	3,90	3,9	0 ,4	3,9
Total					**569,7**	**689,9**	**100**

♣ *Level of water deficit at the second sowing date*

Table VI below presents the result of the assessment of the level of water stress experienced by the cultivation of rice sown on 20/12/2016 (D2). The result is that the rice planted on that date has had a total water stress level of 164.2 mm throughout its life cycle, expressed in terms of the need for irrigation water.

The most important irrigation requirements are in the initial phase of cultivation in the second decade of December with 90mm per decade and are averagely in the late-season phase in every third decade of May (16; 31.3 and 26.9mm per decade)

Table VI. Levels of water deficit in sown rice as of 20/12/2016

Month	Decade	Phase	Kc	ETc	ETc	Rain eff.	Bes. Irr.
			coeff	Day/mm	Dec/mm	Dec/mm	Dec/mm
Dec	2	Init	1,06	3,04	30,4	44,5	90,0
Dec	3	Init	1,1	3,10	34,2	43,9	0,0
Jan	1	Init	1,1	3,08	30,8	41,0	0,0
Jan	2	init	1,1	2,98	29,8	41,7	0,0
Jan	3	Believe	1,11	2,94	32,3	46,1	0,0
Feb	1	Believe	1,12	2,93	29,3	53,9	0,0
Feb	2	Believe	1,14	2,93	29,3	59,4	0,0
Feb	3	Believe	1,16	2,94	23,5	51,6	0,0
Mach	1	Believe	1,17	2,95	29,5	39,7	0,0
Mach	2	Mid know	1,19	2,95	29,5	32	0,0
Mach	3	Mid know	1,19	2,95	32,4	36,8	0,0
Apr	1	Mid know	1,19	2,86	28,6	47,2	0,0
Apr	2	Mid know	1,19	2,82	28,2	52,7	0,0
Apr	3	Mid know	1,19	3,22	32,2	38,7	0,0
May	1	Arr sais	1,18	3,63	36,3	20,3	16,0
May	2	Arr sais	1,14	3,87	38,7	7,4	31,3
May	3	Arr sais	1,11	3,98	31,8	3,6	26,9
Total					**567,9**	**690,8**	**164.2**

♣ ***Levels of water deficit at the third sowing date***

Table VII below presents the result of the assessment of the level of water stress experienced by the cultivation of rice sown on 27/12/2016 ie (D3). From this result it follows that the cultivation of rice sown on that date has had an overall water stress level of 195.7 mm throughout its life cycle, expressed in terms of the need for irrigation water. The most important irrigation needs are in the initial phase of cultivation in the 3rd decade of December with 90mm per decade and are medium in the mid-season phase in the 1st decade of May (16.6mm) and in the late-summer phase in the last two decade of May and the first decade of June (32.5, 39.9 and 16.7mm per decade)

Table VII. Levels of water deficit in sown rice as of 27/12/2016

Month	Decade	Phase	Kc	ETc	ETc	Pluie eff.	Bes. Irr.
			coeff	Day/mm	Dec/mm	Dec/mm	Dec/mm
Dec	3	Init	1,07	3,03	33,3	43,9	90,0
Jan	1	Init	1,1	3,08	30,8	41	0,0
Jan	2	Init	1,1	2,98	29,8	41,7	0,0
Jan	3	Believe	1,11	2,93	32,2	46,1	0,0
Feb	1	Believe	1,11	2,91	29,1	53,9	0,0
Feb	2	Believe	1,13	2,90	29,0	59,4	0,0
Feb	3	Believe	1,15	2,92	23,4	51,6	0,0
May	1	Believe	1,17	2,94	29,4	39,7	0,0
May	2	Believe	1,19	2,95	29,5	32	0,0
May	3	Mid know	1,2	2,98	32,7	36,8	0,0
Apr	1	Mid know	1,2	2,89	28,9	47,2	0,0
Apr	2	Mid know	1,2	2,84	28,4	52,7	0,0
Apr	3	Mid know	1,2	3,25	32,5	38,7	0,0
May	1	Mid know	1,2	3,69	36,9	20,3	16,6
May	2	Arr-sais	1,18	3,99	39,9	7,4	32,5
May	3	Arr-sais	1,14	4,08	44,8	4,9	39,9
June	1	Arr-know	1,11	4,19	16,8	0,0	16,7
Total					**572,3**	**673,8**	**195,7**

♣ ***Levels of water deficit at the fourth sowing date***

Table VIII below presents the result of the assessment of the level of water stress experienced by the cultivation of sown rice as of 03/01/2017 (D4).

It follows from this result VII that the cultivation of rice sown at that time has had an overall level of water stress of 230.7 mm throughout its life cycle, expressed in terms of the need for irrigation water.

The most important irrigation needs are in the initial phase of cultivation in the second decade of January with 56.5 mm per decade and are medium in the mid-season in the first decade of May (16.9mm) and in the late season in the last two decade of May (33.5 and 46.4mm per decade) and the first two decade of June (42.7 and 34.7mm per decade).

Table VIII. Levels of water deficit in sown rice cultivation of the 03/01/2017

Month	Decade	Phase	Kc	ETc	ETc	Rain eff.	Bes. Irr.
			coeff	Day/mm	Dec/mm	Dec/mm	Dec/mm
Jan	1	Init	1,09	3,05	30,5	41	56,5
Jan	2	Init	1,1	2,98	29,8	41,7	0
Jan	3	Init	1,1	2,92	32,2	46,1	0
Feb	1	Believe	1,1	2,88	28,8	53,9	0
Feb	2	Believe	1,12	2,87	28,7	59,4	0
Feb	3	Believe	1,14	2,9	23,2	51,6	0
Mach	1	Believe	1,16	2,92	29,2	39,7	0
Mach	2	Believe	1,18	2,94	29,4	32	0
Mach	3	Mid-know	1,2	2,99	32,9	36,8	0
Apr	1	Mid-know	1,21	2,92	29,2	47,2	0
Apr	2	Mid-know	1,21	2,87	28,7	52,7	0
Apr	3	Mid-know	1,21	3,28	32,8	38,7	0
May	1	Mid-know	1,21	3,73	37,3	20,3	16,9
May	2	Arr-know	1,21	4,09	40,9	7,4	33,5
May	3	Arr-know	1,17	4,21	46,3	4,9	46,4
June	1	Arr-know	1,13	4,28	42,8	0,1	42,7
June	2	Arr-know	11,1	4,42	4,4	0	34,7
Total					**580,7**	**648,6**	**230,7**

3.5. Correlation between fresh biomass and water deficit

The results show that the correlation is negative between the water deficit and the fresh rice plant biomass (r = 0.99) of rainfed rice with a threshold of 5% (Figure 1).
The increase in water deficit leads to the decrease of the biomass as the need for water increases, the result is significantly influenced with the value of R2 = 0.983.

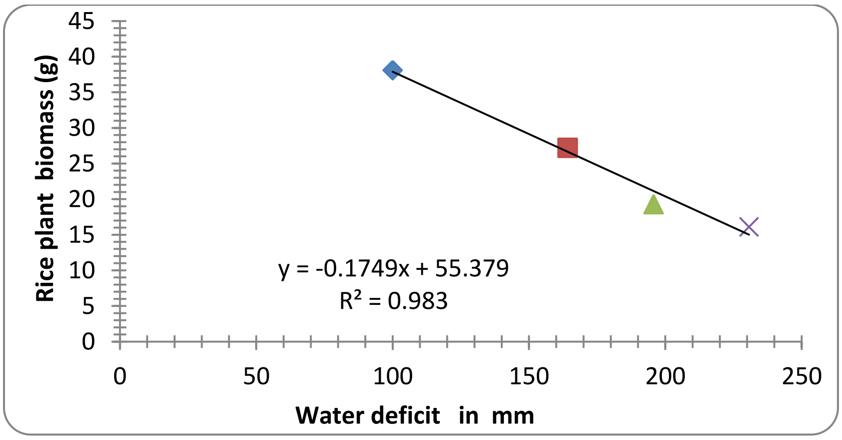

Fig II. Variation of the fresh biomass of rice according to the water deficit

4. DISCUSSION

The results obtained from this study show that only the sowing date had a significant influence on all the growth parameters studied, whereas the interactions between the sowing date and the droppings of the hens did not significantly influence them.

It is the same with the application, alone, of the dung of hens for which the effect is not significant. The results found in Tables II and III reveal the significant effect of sowing date on rice growth parameters, corroborating those of many authors who have shown that crop growth and yield vary with the time of their sowing and / or planting. The sowing date has a positive impact on the earliest sown plots [8].

This confirms our results obtained on the growth parameters relating respectively to number of leaves, the height of the plants and the number of tillers during the heading period, for which the first two dates (D1 and D2) gave the best results compared late sown dates (D3 and D4) where a reduction is recorded. Evaluating the effects of 3 planting dates on rice yield in Iran, show that yield decreases with early sowing and has increased from 6357 kg / ha on early seeded plots to 5576 kg / ha on seeded seedlings. tardily. On the other hand, despite the strong influence of sowing date on emergence, its effect on grain yield did not negatively affect yields [9].

Moreover, given the importance of rain as an essential factor for crop production, very early and / or late sowing does not benefit the crop all the rainfall recorded during the cropping season. The results found in Tables II and III show the insignificant effect of hen dung on growth parameters, which is consistent with several authors who have shown that crop growth and yield are not significantly influenced by growth. organic fertilization. [10]

working on M. Oléifèra, shows that three months after sowing, fertilization did not cause any significant variation in the size and diameter of M. Oleifera. It was not until the sixth month after sowing that fertilization at 125g of droppings / plant yielded a rate of increase in size of 74% and diameter of 90.7% compared to the control. . This suggests that the effectiveness of growth stimulation by organic manure [11] would be preceded by a latency period of at least three months. This period would be attributed to the time required for soil microorganisms to enter into activity, mineralize a sufficient amount of organic matter, and allow uptake and pronounced accumulation of dry matter by plants. This corroborates the results obtained in this work which shows that, the height of plants experienced a rate of increase in height increased from 0.9 cm to 0.873 cm compared to the control, during the period of heading increased with manure to nitrogen nutrition that has improved. It is the same with regard to the number of tillers passing from 0.159 tillers / plant to 0.856 tillers / plant. These results were confirmed by [12]. This is consistent with the idea that organic matter is the best basic fertilizer [13]; but invalidates that it does not provide enough nutrients to support excellent plant growth and thus maintain soil fertility [14].

This justifies the interest of associating chicken droppings with mineral fertilizer to ensure a balance between the contributions and the needs of the plants. Furthermore, the performance of these growth parameters observed at the heading period would be induced by the supply of maintenance urea carried out 50 days after sowing, which would have the effect of mobilizing nutrients in large quantities. The results presented in Tables II and III concerning the interaction between sowing date and manure show a non-significant influence by the fact that the effect of sowing date masked that of manure. This can be explained by the results obtained on the biomass indicating that the weight of the fresh biomass was greater F0 in the first and fourth date of sowing compared to F3 and F2.

This can be explained by the fact that, under natural conditions, a soil is certainly not perfectly homogeneous and that it can be more fertile in places. What does not agree with the words of [15] by gradually increasing the doses of the organic matter, one regularly improves the agrological situation of the cultivated grounds. These results are similar to the best performance observed in F3 in the context of this study, which means that a growing intake of chicken droppings of 0kg, 1kg, 2kg, and 3kg / ha is necessary since, in general, Vegetative growth was best achieved with the F3 dose (Table 3.1 and 3.2). F0 did not induce the best growth of plants. The low nutrient content in the soil explains the situation on F0. [16] states that growth is only possible when nitrogen and potassium requirements are met

The results found in this study on the assessment of water stress on rice growth parameters. Table V shows that rice plants have undergone global water stress, the most important irrigation needs are in the initial phase of December in the second dekad and in the late season of the month. of May (from the first to the third dekad) for the first and the second sowing date of the culture against against the third (D3 and D4) is 27/12/2016 and 03/12/2017, the need for water is in the introductory phase in December in the second dekad and in May at the beginning of the mid-season to the first dekad, which extends until June in the late-summer phase of Culture. Table I shows the amount of rainfall, or even the frequency with which rainfall was occurring, to meet the demand of the crop. Thus it was found on 13/12/2016 that the soil was not sufficiently wet at the initiation phase because it had a water deficit of 100 mm, which would affect the saturation of the porosity of the soil, while rice needs it to maintain its average rooting. This would partly explain the delay in emergence observed on plots sown in this date. In fact, [17], show that the sowing date has an impact on the emergence in the most sown plot, delaying it. Despite the strong influence of sowing date on emergence, its effect on grain yield did not negatively affect yields. On the other hand in (D2) the deficit was of the order of 164.2mm of water, there at least the soil had received a little enough water so the effective rain was enough enough. Finally on the fourth date the need for irrigation increased with 230.79mm water following the definitive cessation of the rains. Indeed, this lack of water has caused a delay of the heading which has repercussions on the vegetative cycle by prolonging it by a few days. This confirms the idea of [18] that a period of water stress, more or less long before heading, prolongs the cycle by more than ten days. Thus late sowing, considered as severe water stress, lengthens the cycle of the plant while fertilization contributes to its reduction.

The variation of the cycles that we observed according to the dates of sowing may be due, not only to the delay of sowing, but also to the irregularity of the rainfall causing near drought during the development of the plant [19] . In addition, soil organic matter has been an external factor that allows rice to resist moisture stress. Indeed, the organic matter has a large capacity of water retention in the soil. In addition, it releases slowly and regularly mineral elements that can in turn promote the maintenance of water in the soil (case of potassium for example).

CONCLUSION

The present study was initiated to analyze the behavior of rain-fed rice cultivated on a Ferralsol throughout its growing season, taking into account the influence of different sowing dates and increasing doses of dungs. chickens.

The trial was installed on a Ferralsol using a factorial device in 3 replicates with four sowing periods and four doses of chicken droppings. The observations focused on the parameters of rice growth and the need for irrigation.

The results obtained from the observations made on the vegetative parameters revealed that the priority edaphic constraints for the growth and the vegetative development rice in the study environment, were not lifted by the contribution of the dung of the hens. Its beneficial

action would be further enhanced for its improving role of soil structure and the protection of the soil against sunstroke and risk of beating.
As a suggestion we suggest that hen dung always be associated with mineral fertilizers. Combination of hen dung and mineral fertilizer creates the best production conditions because organic matter improves soil properties, while mineral fertilizers provide plants with the nutrients they need and increase agronomic efficiency.
In addition to this it will also take into account the climatic requirement of the plant, for the cultivation of rainfed rice, it would be necessary to perform the irrigation rate and during the crop cycle finally to ensure water demand

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