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Selection of oat varieties to the North of Morocco

Need of diffusion and renewal of the varieties

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Abstract. Oat is the main fodder culture in the Northern West region of Morocco where it is used as green, hay, silage or grain. However, the improvement of this culture faces several constraints related to the unavailability of varieties adapted to local conditions characterized by a long rainy period and development of many leaf diseases. This study summarizes the efforts in the selection and dissemination of high yielding varieties with a long development cycle and good resistance to foliar diseases. Five varieties namely Ghali, Tissir, Zahri, Amellal and Nasr, have been selected and recommended for the area. In experimental station, these varieties reach yields of 12 tons of dry matter (DM) and 4.5 tons of grain per hectare while some imported varieties capped at 6 and 3 tons per hectare of DM and grain respectively. In the field, new varieties record yields of 10 tons and 2.4 tons per hectare of DM and grain respectively, against only 6 tons of DM and 0.6 tons of grain per hectare for local seed widely used in the region.

Keywords. Selection – Oat – North of Morocco – Leaf diseases – High yield – Dry matter – Grain.

Sélection de variétés d'avoine pour le Nord ouest du Maroc: diffusion et renouvellement des variétés

Résumé. L'avoine est la principale culture fourragère dans le nord ouest marocain où elle est exploitée soit en vert, en foin, par ensilage ou en grain. Cependant, le développement de cette culture a été confronté à plusieurs contraintes dont en particulier l'indisponibilité de variétés adaptées aux conditions de la région caractérisées essentiellement par une longue période pluviale et les attaques fréquentes de maladies foliaires. La présente contribution met en évidence les résultats des programmes de sélection de variétés performantes adaptées à la région. Au moins cinq variétés, Zahri, Amellal, Tissir, Nasr et Allal sont actuellement recommandées pour la zone en raison de leur cycle de développement assez long et leur résistance à la rouille brune et au mildiou. En station expérimentale, ces variétés atteignent des rendements en biomasse de 12 tonnes de matière sèche (MS) et 45 quintaux de grains par hectare alors que certaines variétés importées plafonnent à 6 tonnes MS et 30 quintaux de grains par hectare. Au champ, les nouvelles variétés enregistrent des rendements de 10 tonnes et 24 quintaux par hectare de matière sèche et de grains respectivement contre seulement 6 tonnes et 6 quintaux par hectare pour la semence locale largement utilisée par les agriculteurs.

Mots-clés. Sélection – Avoine – Nord du Maroc – Rendement – Biomasse – Grain – Maladies foliaires.

I – Introduction

The improvement of oat (*Avena sativa* L.), started in Morocco from the 80's years of the last century, have led to the selection of a panel of high yielding varieties adapted to soil and climatic conditions of different agro-ecological regions of the kingdom. For the North West region where the oats are the main crop of the forage sole (Noutfia, 1994), the selection criteria apply, in addition to the biomass and grain productivity, other criteria specific to the region. These criteria are mainly related to relatively late growth cycle, covering the period of late rains between November and mid-May. This period corresponds to the best time for the preparation of hay. Also, tolerance or resistance to leaf diseases including leaf rust, powdery mildew and viral budding barley are also important in breeding programs for the northern area saw the importance of damage caused annually on susceptible varieties (Alfaiz *et al.*, 1990 and 1997; Noutfia *et al.*, 2003 Noutfia *et al.*,

2003). The selected varieties were also tested in several sites in the region with farmers during the last years. They are conducted and compared with local seeds widely used by farmers and with some imported varieties. The production potential of these varieties, in experimental station and in farms, go well beyond the local varieties and the imported variety. However, some of these varieties showed some fairly significant damage caused by attacks due to leaf rust (*Puccinia coronata fsp avenae*) that happens every year in the area. Indeed, it is well accepted that the varietal resistance of oats to rust can be broken by more virulent strains of the pathogen (Alfaiz, 1997). Therefore, updating and renewal of the panel of varieties is essential to overcome these risks and cope with the varietal degeneration which gradually reduces the performance of the varieties. This contribution aims to show the potential production of new varieties with the aim to extend the range of recommended varieties for the northern zone.

II – Material and methods

1. Diffusion of new varieties in the region

Two varieties (Tissir and Zahri) were tested with producers in four localities in the region (Chefchaouen (35°06 N; 5°30 W), Asjen (34°57N; 5°35W), Bouhmed, and Had Gharbia (35°12N; 6°09W)). Demonstration plots were installed for comparison with an imported variety (Hamel) and local seed. The monitoring was conducted during the 2005, 2006 and 2007. The comparison was made on the basis of dry matter and grain yields and resistance to rust.

2. Comparison with other varieties

Five new varieties of oats have been tested in comparison with two control varieties namely Amellal and Zahri in Tangier. The trial was installed in the experimental domain of INRA Tangier (Bougdour 35°45 N and 5°45 W) in a clay loam soil, under rainfed conditions. The climate of the locality corresponds to a sub-humid Mediterranean type with mild winters and with mean temperatures of 10.0°C min and 27.5°C max and total precipitations of 755 mm. Sowing was done on large plots of 100 square meters per variety on the 10 of December 2007. The basic fertilizer 30-80-60 corresponds to units of nitrogen, phosphorus and potassium respectively. Coverage fertilization, focused on the addition of two doses of nitrogen of 30 units each at tillering and heading stages. The comparison between varieties was made on criteria related to vegetation height measured on 10 plants per plot and three replicates and determined between the first node and the output of the last sheet. Biomass yield is determined by the harvest of three square meters per plot in full bloom and the determination of dry matter content of three samples of 500 g per plot after oven drying at 70°C for 48 hours. Behavior with respect to foliar diseases is scored on a graduated scale ranging from 5 in the absence of any attack to 1 when the attack is spread over the entire plant. Earliness is approximated by observing the flowering date of each variety representing 50% of flowering plants. Analysis of the results for the yield and the height of plants was made by analysis of variance while the earliness and disease resistance were compared with controls.

III – Results and discussion

1. Diffusion of varieties in the region

Performance levels achieved in the different localities in the area show a marked improvement over the local seed used by farmers and the imported variety (Hamel). Thus, at experimental stations an average yield of 12 tons of dry matter and 4.5 tons of grain per hectare were obtained with the new varieties Tissir and Zahri. By cons, the variety Hamel recorded yields per hectare of

6 tons of dry matter and 3 tons of grain due to a widespread attacks of brown rust. The new varieties allow some production stability due to their tolerance to disease and better response to improved technology led. Thus, in a wet year on relatively heavy soil, the variety Tissir reached a yield of UF 3443 against just UF 2795 for the variety Hamel. Similarly, among the producers of the four localities in the region (Chefchaouen, Asjen, Bouhmed, and Had Gharbia), these new varieties have recorded average yields of 2.4 tons of grain and 10 tons of dry matter per hectare. In similar circumstances, the yields obtained with local seeds did not exceed an average of 0.6 tons of grain and 6 tons of dry matter per hectare (El Mourabit *et al.*, 2007). Therefore, a producer has been chosen for the multiplication of two varieties (Tissir and Zahri) since 2006 with an improved technical conduct which enables him to achieve average yields of 3.0 tons of grain per hectare. (El Mourabit *et al.*, 2007). Concerning the attacks of rust, the variety Hamel and local seeds were devastated every year. For the improved varieties, even the variety Zahri shows moderate attacks estimated at 50% in the locality of Asjen, it is free like the other variety Tissir in other localities.

2. Comparison with other varieties

The installation and removal of varieties has been good and consistent. Vegetative development of plants showed that three of the new varieties (5, 9 and 8) are more vigorous than the control varieties and have a late development cycle of about one week compared to control Zahri. Flowering period was distributed over the second decade of April with a gap of two weeks between the early varieties and the later one (var. 8). The levels of dry matter yields obtained are less than the usual potential due probably to that the seeding was done with a delay of about one month reducing the growth period which could affect negatively the final yield. Two new varieties have recorded dry matter yields significantly higher than the others (8-9 ton DM ha⁻¹) but not different from the control Amellal (Table 1). Thus, the higher yield of dry matter made by both varieties 5 and 9 is related more to the strength of the plant, the cycle length and the absence of fungal diseases. The variety 5 which registered the best performance has also the highest finesse rods with an abundance of foliage. This variety because of its morphology characterized by abundant foliage will have a great asset to farmers for the preparation of the hay.

Table 1. Characteristics of different oat varieties tested

Variety	Plant height (cm)	Flowering date (vs control 1)	Rust level	Dry matter content (%)	Dry matter yield (ton ha ⁻¹)
Var.5	117.3a	+ 6 days	4	26b	8.15a
Var.6	86.7b	+ 6 days	4	28ab	5.89b
Var.7	88.9b	0 day	4	25b	4.91b
Var.8	105.7a	+ 8 days	5	23b	6.07b
Var.9	115.9a	5 days	5	27ab	9.48a
Zahri (Control 1)	95.6ab	16 april	5	28ab	7.26ab
Amellal (Control 2)	98.9ab	11 april	5	30a	9.03a
P<0.05				P<0.05	P<0.05

IV – Conclusion

The selected varieties recorded higher dry matter and grain yields than local seed and imported variety. During this period, these new varieties have been spared rust except the variety Zahri which was substantially attacked in the Asjen locality. For local seeds, the attacks were systematic and rust damage usually compromise the production. These results highlight the importance of the introduction of suitable varieties for higher yields and therefore farmers' incomes. Moreo-

ver, the multiplication of these varieties by the farmers themselves can contribute greatly to their dissemination in the area. Finally, the attacks of rust on the control Zahri, demonstrates the need for continuous renewal of the range of varieties to escape the attacks of the diseases. This objective was reached with two new varieties that showed performance beyond the control varieties known for their adaptation to the area. These two new varieties in addition to their vegetative state comparable to that of controls have a longer growing cycle and a vigorous vegetative aspect and are more suitable for the preparation of better hay.

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