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Phenologic observations and agronomic features of three local Poaceae fodder grasses in North East Algeria

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SUMMARY – A behavioural test was applied to highlight the phenologic stages and the notation of some agronomic features of three local fodder grasses, *Lolium multiflorum* Lamk, *Festuca arundinacea* Schreb and *Phalaris arundinacea* L. The results obtained show that generally, the three species present higher germinating ability in laboratory conditions, and good germination (>70%) in the soil. With regard to the phenologic stages, it was noted that the ryegrass and the tall fescue had similar chronological evolution. The red canary grass cycle was different. Otherwise, the notation of agronomic characters showed that in the shooting stage, ryegrass was vulnerable to lodging; tall fescue was less vigorous during winter, especially in the first year of sowing. The following years, the tall fescue reacted better to cold weather conditions, dryness and floods. The red canary grass was slightly sensitive to rust and oidium diseases. As a whole, these ecotypes seem to have quite good general rusticity.

Keywords: Behaviour, phenology, rusticity, fodder grasses, fungal diseases.

RESUME – *"Observations phénologiques et caractères agronomiques de trois graminées fourragères locales (Poaceae) dans le nord-est de l'Algérie". Ce travail consiste en un essai de comportement pour mettre en évidence la phénologie et la notation de certaines caractéristiques agronomiques de trois graminées fourragères locales :* Lolium multiflorum *Lamk,* Festuca arundinacea *L. et* Phalaris arundinacea *L.). Les résultats obtenus montrent que d'une manière générale, les trois espèces présentent une faculté germinative assez bonne (>70%). En ce qui concerne les stades phénologiques, on constate que le ray-grass et la fétuque ont une évolution chronologique similaire contrairement à l'alpiste. Les caractères agronomiques montrent que le ray-grass est vulnérable à la verse surtout au stade montaison; la fétuque est moins vigoureuse pendant l'hiver surtout, la première année de semis. Les années suivantes, elle réagit mieux au froid, à la sécheresse et à l'inondation. Par contre l'alpiste est légèrement sensible aux maladies: rouille et oïdium. D'une manière générale, ces écotypes semblent présenter dans l'ensemble une rusticité assez bonne.*

Mots-clés : *Comportement, phénologie, rusticité, graminée fourragère, maladies cryptogamiques.*

Introduction

The knowledge of the local species potentialities requires after the first work of prospecting, the characterization of the vegetable material and consequently the analysis of its variability. This analysis should permit to renew the agricultural potential, creating a genic tank that only the genes banks will be able to perpetuate (Huon, 1983). In Algeria, several prospecting have been achieved on fodder species and pastoral interest; The last one was interested to the legumes and also to the Poaceae perennial as the rye-grass (*Lolium multiflorum* Lamk), the tall fescue (*Festuca arundinacea*. Schreb), the dactyl (*Dactylis Glomerata* L.) and the red canary grass (*Phalaris arundinacea* L.) (Abdelguerfi et Laouar, 2002). Otherwise, such a study should permit to gather the maximum of data encouraging the introduction of these species into a selection diagram, knowing that the first appeared varieties of graminaceous fodder have been improved from wild ecotypes and some marketed natural populations of other countries (Mansat, 1975). The objectives and aim of this present work is to determine: (i) the phenologic stages from seedling until harvests on several years, and (ii) the agronomic features notation like the vigor, alternativity, the sensibility to the diseases and to the cold.

Materials and methods

Three spontaneous fodder species belonging to the family of the Poaceae were the subject of the actual work. The seedling has been achieved in naked soil. The climate of the survey region is Mediterranean characterized by a yearly average temperature of 17°C and a yearly rainfall of 600-800 mm. Soil was made of a balanced texture (sandy-slimy-clay).

The studied parameters were the recognition of the different phenologic stages, by scale of Gate (1987) and (Jeangros and Amaudauz, 2005) the sensitivity to the diseases by scale of Mc Intosh and Eveling (1969), and the notation of some agronomic parameters.

Results

In laboratory conditions, seeds of the three species are viable and presented a good germinative faculty (100%). However, the best germination percentage in the soil has been observed in red canary grass (100%), followed by the tall fescue (78%) and the rye-grass (74%) (Table1). Thus, statistical analysis showed significant differences between species at $p<0.05$.

Table 1. Germinative faculty and dates of the main phenologic stages in days and heat accumulate in degree day (Sum temperatures index: ∑θ). The duration of the phenologic stage and the calculation of the sum of temperatures index is a function of the date of seedling

	L. multiflorum Lamk	*F. arundinacea Schreb*	*P. arundinacea L*
Percentage of germination (%)	74%	78.7%	100%
Number of days and degree x day ∑θ, (temperatures >0°C)			
Lifting duration	14 (∑θ, 219°C)	22 (∑θ, 345°C)	19 (∑θ, 298°C)
Tillering duration	29 (∑θ, 445°C)	29 (∑θ, 445°C)	50 (∑θ, 691°C)
Shooting duration	53 (∑θ, 740°C)	53 (∑θ, 740°C)	62 (∑θ, 844°C)
Heading duration	170 (∑θ, 2203°C)	170 (∑θ, 2203°C)	160 (∑θ, 2040°C)
Heading duration	177 (∑θ, 2309°C)	177 (∑θ, 2309°C)	170 (∑θ, 2192°C)

For the tall fescue the rye-grass, the lifting took place 22 and 14 days after sowing, respectively. The red canary grass reached this stage in an intermediate time of 19 days. In addition, it has been observed that the variation of this character according to the species was not important and significant at the 8th day. The tillering stage has been obtained 29 days after the sowing for both the tall fescue and the rye-grass. In contrast, the same stage has been reached after 58 days for the red canary grass. The shooting is a phase of the first development characterized by a slow elongation, then more and faster of the enter-nodal of the main stem and tillers, and by the differentiation and the magnification of inflorescences. The past time from the seedling to the shooting was 53 days for the rye-grass and the tall fescue, and 62 days for the red canary grass. The heading stage has been reached in 160 days after sowing for the red canary grass. However, for the rye-grass and the tall fescue, the heading dates were homogeneous, where it took place during 170 days. The date of realization of this stage varies according to the varieties, the places and years. According to Niqueux and Arnaud (1981), the date of heading of a given variety can be predicted from the knowledge of the climatic characteristics, the place of culture, based on the sums of Q_{1O} temperature to give better account of the low temperatures. The time from sowing to heading was 170 days for the red canary grass, and 177 days for both the tall fescue and the rye-grass.

The Table 1 express the realization of the plant phenologic stages according to the accumulated heat in degree/day during the whole vegetative phase (Sum Temperatures Index: STI). The STI showed that the lifting stage requires an accumulated temperature of 219°C, 298°C and 345°C for respectively, the rye-grass, the red canary grass and the tall fescue. Concerning the tillering, the red canary grass needs 690°C, whereas the need of the tall fescue and the rye-grass, were 445°C, 740°C, 2203°C and 2309°C for the respective stages of tillering, shooting, heading and heading. Thus, red canary grass is relatively more heat demanding for the realization of the phenologic

periods, except for the heading that has been achieved one week in advance compared to the two other species with an accumulated heat of 2192°C/day. In general, the chronological evolution of the phenologic stages was nearly similar at the three lineages.

Table 2 of the inter-annual variation of the stage sowing-lifting and sowing-heading in days (from 1995 to 2000) showed that the variation can be significant from one year to another. The most important variation has characterised the ray-grass and the tall fescue. The inter-annual variation of the seedling-lifting stage was also significant. The difference between the plant that raised early and those that rose late were located on average between 5 days for the rye-grass and 7 days for both red canary grass and the tall fescue. Concerning the stage seedling-heading (grazing stage), the yearly gaps were relatively weak. The average gaps within the species are 3 days for the red canary grass, 9 days for the rye-grass and 10 days for the tall fescue. The average inter-specific and inter-annual variation was around 9 days. Otherwise, the comparison of the duration of realization of this stage between the most precocious year and the year most belated were located here at the surrounding of 6, 19 and 23 days for the red canary grass, the tall fescue and the rye-grass, respectively.

Table 2. Duration of the phenologic stage seedling-raising and seedling-heading in days for several Years (1995-2000)

	Stage	Year					X±SD	CV (%)
		95/96	96/97	97/98	98/99	99/00		
P. arundinacea L	S.L	11	22	90	12	19	16.8 ± 2	42.73
	S.E	158	156	161	162	159	159 ± 2.13	1.34
F. arundinacea Schreb	S.L	35	19	26	24	22	25.2 ± 5.4	21.5
	S.E	178	165	184	169	170	173 ± 6.8	3.95
L. multiflorum Lamk	S.L	11	21	18	20	14	16.8 ± 3.8	22.4
	S.E	178	155	165	69	170	167 ± 7.5	4.5

S.L - seedling-lifting stages; S.E - seedling-heading stages; CV - coefficient of variation;
SD - Standard deviation.

On the basis of the observation set, the five years can be classified according to their phenologic precocity by the following way: precocious year: 1997; middle years: 1999, 2000; belated years: 1996, 1998. This general ordering corresponds to the date of seedling until the full heading stage of the 3 species in the Fetzara Station.

The principal agronomic characters kept in this survey are reported in the Table 3.

Table 3. The main agronomic characters of the 3 Poaceae fodders

	L. multiflorum	*F. arundinacea*	*P. arundinacea*
Alternativity	+	+	+
Vigour	+	-	+
Disease sensibility	0	0	(3) Rust, (3) Oidium
Cold weather resistance	+	+	+
Resistence to laying down	-	+	+
Re-shooting aptitude	good enough	good enough	good enough

(+): alternative, vigourous, resistant.
(-): non alternative, non vigourous, non resistant.
(0 and 3): infection degree according to the studied scale.

The studied species are all alternatives. The character of vigour has been noted two months after

the seedling. Put a side, the tall fescue, which was weak and sensitive in the first year of sowing, the two other species were rather vigorous. Concerning the sensitivity to the diseases these species the rye-grass and the tall fescue did not express any symptom of diseases. For the red canary grass, it was observed orange rust and a white spots on the leaves (odium) with a degree of infection of 3 for the two respective diseases. Concerning, the parasitic attack, only, the tall fescue was otherwise vulnerable to the slugs in the humid conditions. The resistance to the cold weather has been appreciated by the plant kinetic growths in height during the coldest month (January) and the resumption of vegetation in the spring (March). Indeed, the wintry growth is 27, 27, and 24 cm/month for respectively, the red canary grass, the tall fescue and the rye-grass against 40, 48 and 37 cm/month in the order of the same species for the spring growth. In a global way, the studied ecotypes seem to present the same resistance to cold weather. Concerning the resistance to the laying down of crop by the wind, it appears that only the rye-grass was especially sensitive when it did not undergo any cuts and that it arrives to the heading stage. However, all the studied species, present a good faculty to the re-shooting. The measure of the vegetation heights (non presented data) to the second and third cut showed an important development with an average of 65 cm. Finally, for the precocity it did not show notable differences between the various species. The gap to the heading between the three species was 7 days.

Discussion and conclusions

The phenologic study, show that the best germinative faculty is obtained by *P. arundinacea* and that as a whole the remain two species of *F. arundinacea* and *L. multiflorum* present a faculty superior to 70%. This weakness of germination comes certainly from the dormancy of certain seeds (Ostrem, 1988) or notably, the physiological maturity; the physical and sanitary state of the seeds (Hedecker,1969).The temperature of soil in non limiting water conditions is the explanatory factor of fluctuations observed of the seedling-lifting phase. The phenologic stages evolution, noted that *L. Lamk multiflorum* and *F. arundinacea* have similar chronological evolution. To the same date, the difference of stages between precocious and belated year is not very significant, where the gap is lower to 10 days. The notation of the agronomic characters shows that the rye-grass is vulnerable to the laying down, especially at the shooting stage; the tall fescue is less vigorous during the winter, but according to our personal observations, it is only sensitive to the climatic conditions during the first year of sowing. In the following years, it reacts better to the cold weather, to the drought and to the flooding. On the other hand, the red canary grass is slightly sensitive to the diseases represented by rust and odium, when the soil conditions of humidity and temperature are favourable. In a general way, these ecotypes seem to have as whole a rather good rusticity.

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