International Journal of
Science and Engineering Investigations vol. 1, issue 10, November 2012
ISSN: 2251-8843

Relationship between the Seed Weight of Some Ecotypes of Four Vetch Species (V. Sativa, V. Narbonensis, V. Dasycarpa and V. Ervilia) and Their Germination

Bousba A.[1], Djekoune A.[2], Hafsi M.[3]
[1,3]Laboratory of Plant and Animal Production, Department of Agronomy, Faculty of Science, UFAS University, Sétif, Algeria
[2]Laboratory of Biochemistry and Plant Biotechnology, Department of Natural Sciences, UMC University, Constantine, Algeria
([1]bousb2000@yahoo.fr)

Abstract-The Vetches are leguminous fodder plants which are very important in Western Asia and North Africa [25; 3] reported that the water needs exceed 300 mm / year and Vetch are adapted to cold regions which receive an average of 350 mm / year of rainfall. [9] Added that Vetch is often cultivated under mild weather and its resistance to be about-5 °C for the spring types and -15 ° C for the winter types. The plants sexual reproduction leads to the formation of a seed that originates in a new individual. The seed is not only a staple in the vital cycle of spermatophytes, but it constitutes also a scattering and a resisting [15]. [19] Define germination as a resumption of development of a reproductive organ of a plant after a period of latent life. Ts is a set of the phenomena by which a seed develops its embryo and gives birth to a plant of the same species as the one formed it. This is the first step of a growing from seed. The germination of a seed, whose determinism is often very complex, depends on many internal and external parameters. The germination of a seed, whose determinism is often very complex, depends on many internal and external parameters. The environmental factors can influence the seed germination are temperature, airing, humidity, and for certain seeds, light. It is a process whose limits are the beginning of this dehydration and the start of the radicle growth. It cannot take place unless some favorable conditions are present. The seed must first get moisturized. The environment must therefore be sufficiently humid. The germination requires oxygen which is necessary for the abrupt increase of the seed metabolism. A good germination requires also an appropriate temperature which is around 20 ° C. On the other hand, the internal conditions are related to the seed itself. The seed must be viable, must have a good sanitary condition, an intact embryo and enough reserves. The plant seed germination ability can be influenced by many internal or external factors including the size of seed. This aspect was first discovered by .The studies of the variation of the seed seize of the Vesce species and its relationship with their germination ability contributes to the selection of a performing vegetal material [10]. The objective of this work is to study the relationship between the weight or the size of the seeds for the ecotypes of four Vetch species (*V. Sativa,V. narbonensis, V. and V. dasycarpaervilia*) with their germination ability at 25° C and 30° C. Forty two (42) ecotypes of four species of the Vetch type (*V.ervilia*L.Wild, *V. sativa* L., *V. villosa*s.l. ssp. *Dasycarpa* (Ten) Cavill), and *Vicianarbonensis*) have been studied under laboratory conditions. The three parameters which were measured (the seeds weigh, germination level and the velocity coefficient) showed differences within the ecotypes of each *species* as well as between the different species. The correlation analyzes showed, in a general manner, a significant relationship between both the species average weight and their germination level and with their average velocity coefficient at 25 ° C. On the other hand the seed weight of the Vetch studied was found to be a negative correlation with their germination ability; i.e. the smaller the seeds the better the germination ability. This negative correlation between the seed weight and their germination ability, which is demonstrated in our study, is a very important factor for the selection of performing species.

Keywords-*Seed weight; Vetch ecotypes, temperature factor; germination ability*

I. INTRODUCTION

In Algeria, the fodder production is insufficient from both qualitative and quantitative points of view. The fodder auricular areas are very limited because of low pluviometry and small irrigated areas that are reserved in priority to vegetable and fruit farming. The whole All of these fodder resources does not satisfy the livestock needs in energy and nitrogen. There is a deficit of 40% of fodder field which has a repercussion on the production of milk, meat, wool and leather [11]. In order to compensate this deficit, it is necessary to encourage the increased of the area and production of the gramineae - fodder field association on one hand, and the improvement of the digestibility and protein / energy equilibrium on the other hand. The leguminous fodders such as vetches offer benefits. It permits the improvement of the soil structure, the struggle against erosion, and supplies them with a fodder rich in protein [9]. We can also make up for this feeder deficit appropriately developing the leguminous fodder, as was already advocated since a long time by [1; 17; 12; 13]; this will satisfy the concern of fallowing land within scope of durable

development based on the principle of the viability of the production systems. In this context, the development politics should consider the fallow as a component of the ovine / cereal production systems because it constitutes a tool of the struggle against the weather hazard and economic risk management [4]. It is to be noted that the use of leguminous plants in the fallow offers many advantages: these leguminous plants represent a fodder which is directly graze able by small ruminants and appreciable supplementary feeder [2]. By avoiding the monoculture, the leguminous fields facilitate the control of the root diseases and the attach by norms [20; 8]. They also help to fight against erosion and improve the soil structure. They improve the production of the dry matter and protein during the cereal-leguminous plants biennial rotations as was shown by different works ICARDA. The also provide the following cereal with an azotic which is allowed by the symbiotic fixation of leguminous plants [26; 5]. Among the leguminous plants which are on farmable in the fallow, the annual species of the Vetch type can be used as hay or as grain for livestock feeding. These vetches are cultivated in association with a fodder crop (oats, barley or triticale) and yield hay with excellent quality [22].

In fact, in these regions where rainfall does not exceed 400 mm / year, the feeding of the livestock is based mainly on grains, the cereal derivatives, oats - vetch association and vegetation left in the fallow. Such feeding does not permit a productive and intensive breeding but would expose the livestock to the ups and downs of climate and the chronic deficiencies of the azotic digestive matter. Usually upon crop rotation (barley – wheat) and especially in humid regions, the land is let lie fallow which facilitates the control of weadsand nitrogen mineralization, reduced the cereal root diseases, and favors the conservation of the water in the soil [2]. In this article, we present the results of the study of the relationship between the seed weight of forty two ecotypes of four Vetch species of (*V. Sativa, V. narbonensis, V. and V. dasycarpaervilia*) and their germination. These species are fodder plants which can be introduced in the production systems to make up for the fodder deficit.

II. MATERIELS AND METHODS

The material used in this study is the seed of 42 ecotypes of the four Vetch types (V.ervilia L.Wild, L. V. sativa, V. villosassp sl. Dasycarpa (and V. narbonensis.).It was supplied from ICARDA (Syria).The seeds are sorted out according to their weight and were graded as small seeds category (S), medium seed category (M) and large seeds category (L).The corresponding weight range of the different categoriesis presented for the four species.

The germination tests were carried out in Petri boxes containing filter paper soaked in water. The boxes are placed in a germination oven in the dark and at two temperatures of 25 and 30 ° C. Water is added every two or three days .The germination tests carried out by [18] showed that the optimum germination temperature for of *Vicianarbonensis, V. sativa, V. dasycarpa* and *V. ervilia* varies between 25 and 30 ° C. These winter annuals speciesare also able to germinate at temperatures varying between 5° C and 30 ° C [3].Each box contained five seeds and the experimental procedure was repeated three times. The seeds were considered as germinated when the radicle was visible. The observations were noted daily at the same time of the day.

Data analysis: In order to determine the relationship between the seed weight of the 42 ecotypes investigated and their germination ability, we have two germination indices: the final germination level (GL) and the velocity coefficient (VC) which gives an indication about the germination rate

- The final germination level is given by the following formula:GL (**%)** = ∑ Ni / Nt where Ni is the number of germinated and Nt is the total number of the seeds to be germinated**.**
- The velocity coefficient is given by the following formula:VC (%**)** = ∑ Ni / Ni.Ti

Where Ni is the number of germinated at time **Ti** expressed in days.

The analyses of the correlation between the weight of seeds of the species and their germination level and their velocity coefficient were made using the STATISTICA software.

III. RESULTS AND DISCUSSIONS

The results obtained for the four species with the three repetitions for each weight category and each ecotype are presented in the following fig.1, 2, 3, 4, 5 and 6.

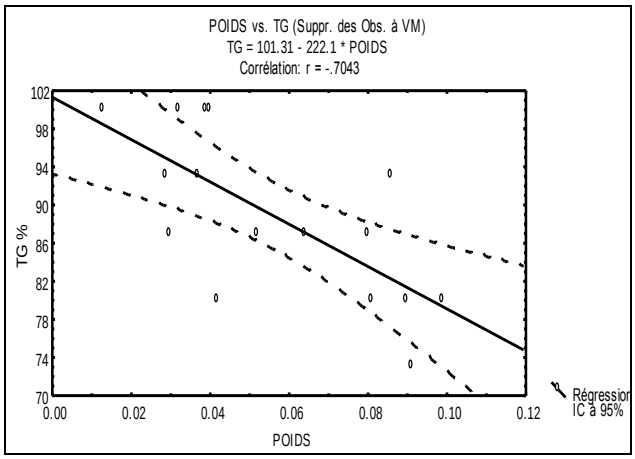

Fig1. Relationship between the weight (gr) of seeds of V. sativa and their germination tare GT (%) at 25 ° C

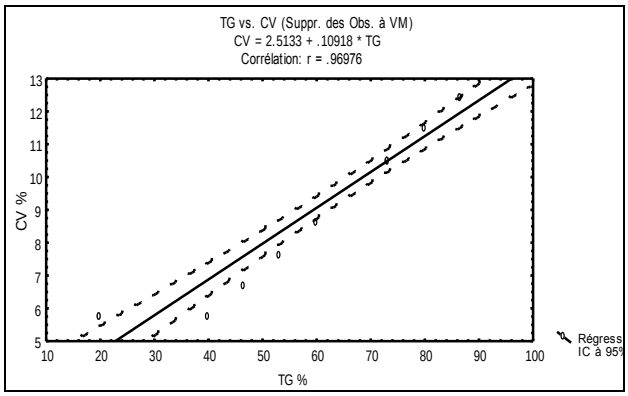

Fig.2. Relationship between the GL (%) of seeds of *V. sativa* and their germination level VC (%) at 30°C

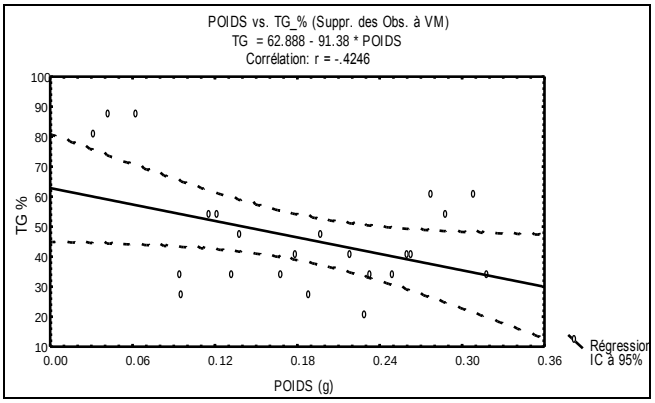

Fig.3. Relationship between the weight (gr) of seeds of V. narbonensis and their germination rate (GR%)

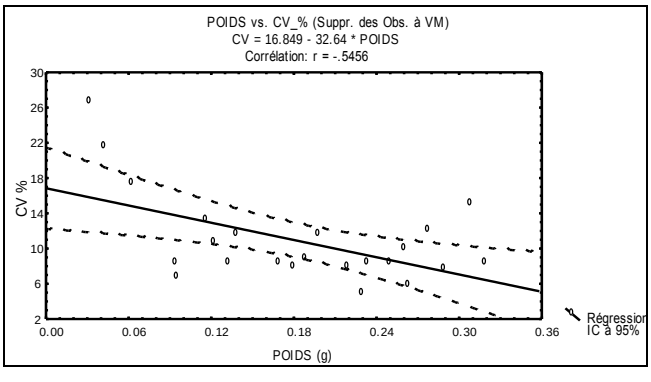

Figure 04: Relationship between the weight (gr) of seeds of *V. narbonensis* and their velocity coefficient (VC %) at 30 ° C

IV. DISCUSSION

Since the objective of this work is to study the relationship between the weight of the seeds of the ecotypes of *V. sativa, V. narbonensis, V. dasycarpa* and *V. ervilia*, and their germination ability at 25 °C and 30 °C. The results obtained showed that the germination level and the velocity coefficient factor vary from one species to another. Within the same species, they vary from one ecotype to another and from one germination temperature to another. The average germination level for all the ecotypes at 25°C is: 94.4% for *V. dasycarpa*, 87.47% for *V. sativa*, 70.20% for *V. ervilia* and 15.35% for *V. narbonensis* (Table 09).At 30 ° C, it is 81.07%, 65.1%, 61.04% and 46.09%respectively. These results show that the temperature of 25°C is more appropriate than that of 30°C for germination of the first three Vetch species. On the other hand the ecotypes of the fourth species, *V. narbonensis*, germinate better at 30°C.According to [10], a good germination requires an appropriate temperature which is around 20 ° C. The results of studies carried out on four species indicate that the optimum germination temperature for the Vetch species is 23°C [6]. This is accordance with the results that we obtained for the first three species. The average velocity coefficient obtained at 25°C is 19.15% for ecotypes of *V. dasycarpa*, 18.64% for *V. sativa* and 20% to 70 *V. ervilia*. They are higher than those obtained at 30°C. The ecotypes of *V. narbonensis*exhibited velocity coefficients relatively higher at 30°C than those at 25°C. These are 10.85% and 3.6%respectevely. In general, except for *V. narbonensis*, the ecotypes of the other species of the Vetch type exhibit better germination levels and velocity coefficients at 25°C. The results of correlation analyses show a significant relationship between seed weight of the ecotypes of *V. sativa* and their germination level at 25°C, with a coefficient equal to -0.70. At this temperature, it is to be noticed that the low values of the coefficients obtained for the ecotypes of *V. narbonensis* and *V. dasycarpa* are negative. The correlations between the seed weight of the ecotypes of *V. narbonensis* and their germination levels and those with their velocity coefficients obtained at 30°C are significant, with a correlation coefficients equal to - 0 .42 and - 0 .55 respectively. As show in Table 1, the comparison of the average weight of the four species of all the ecotypes with their average levels and their average velocity coefficients shows that as the species average weight decreases, the two germination indices increase.

TABLE I. AVERAGE WEIGHT (GR) AVERAGE GERMINATION LEVEL (GL), AND AVERAGE VELOCITY COEFFICIENTS(VC) OF THE FOUR SPECIES (*V.DASYCARPA*, *V. SATIVA*,*V.ERVILIA*, AND *V.NARBONENSIS)*AT 25°C

	Vicia dasycarpa	*Vicia sativa*	*Vicia ervilia*	*Vicia narbonensis*
Average weight (gr)	0.038	0.056	0.051	0.185
Average germination level: GL (%)	94.4	87.47	70.20	15.35
Average velocity coefficients: VC (%)	21.15	18.64	20.70	3.60

In fact, the highest germination levels and velocity coefficients at 25°C and 30°C were noted for *V.dasycarpa* species which presented the smallest seeds. The lowest values of these two indices were noted for *V.narbonensis* which presented the most large-sized seeds.

The correlation analysis of these data shows a significant relationship between the species average weight and their average germination level and their average velocity coefficient at 25°C (Table2).

TABLE II. RESULTS OF THE CORRELATION BETWEEN THE SEED WEIGHT AND THE GERMINATION LEVELS (GL) & THE VELOCITY COEFFICIENT (25°C).

STAT. ELEMENT.	Correlations (4 species 25 °Stat) Significant correlations are marked (*) at p <.05000. N = 4 (Suppression of the observations at VM)		
VARIABLE	Weight (gr)	GL %	VC %
Weight (gr) GL % VC %	1.00 - .97 * - 1.0 *	- .97 * 1.00 .95	- 1.0 * .95 1.00

The correlation coefficients are equal to - 0.97 and - 1.00 respectively. Figure 5 and Figure 6 show that as the species average weight increases, their average velocity levels and their average velocity coefficients of decrease.

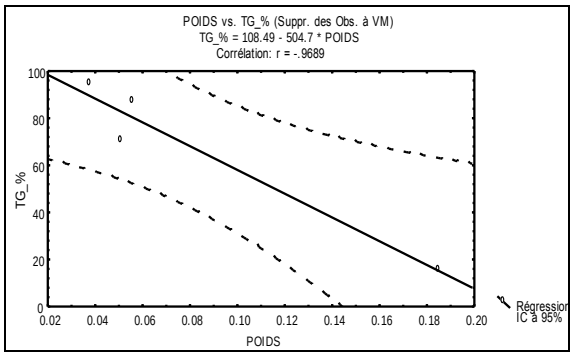

Fig.5. Relationship between the species average weight and the germination rate at 25 ° C

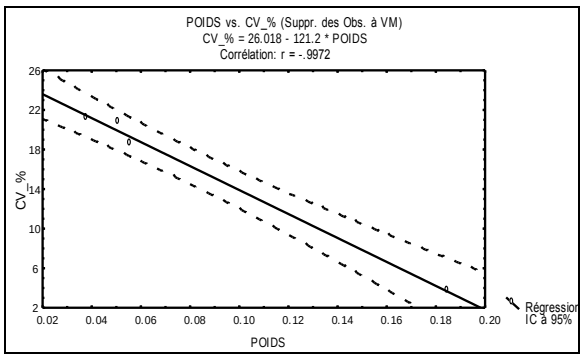

Fig.6. Relationship between the species average weight and the velocity coefficients at 30°C

In general, we can say that there is negative correlation between the seed weight of the species studied and their germination ability at 25°C. That is to say the smaller the size of the seeds the better is their germination ability. This relationship is an important factor which should be used in the selection of performing Vetch species. In addition to the effect of the seed size, the drying of the *V. sativa* grains after their harvest affects the germination rate, the germination level and the seeds dormancy. The seeds which are well dried exhibit higher germination rate and level (> 92%) than those which are relatively humid [23].

V. CONCLUSION

Among the leguminous plants, the Vetch type included many species that are of great ecological and economic interests. They protect the soil from erosion and supply the livestock with a fodder particularly rich in protein. The selection and improvement of the Vetches require a deep study of their biologic and physiologic aspects. The germination, which is a set of phenomena through which a seed develops its embryo and gives birth to a plant of the same species, is influenced by many internal and external factors including the size or the weight of the seeds[5] . The main objective of this work was to study the relationship between the seed weight of *V. dasycarpa*, *V. sativa*, *V. ervilia* and *V. narbonensis*, and their germination ability at 25 and 30°C. The results showed that the temperature of 25°C is more favorable to the germination of the first three species since their germination level and their velocity coefficients are relatively higher at this temperature. They vary between 70% and 95%, and 18 and 21% respectively. The ecotypes of *V. narbonensis* exhibited, through their germination ability a preference toward a temperature of 30°C. The correlation analyzes showed, in general manner a significant relationship between the species average weight and their germination level and their average velocity coefficient at 25°C.There is a negative correlation between the seed weight of the species studied and their germination ability; i.e. the smaller the seeds the better their germination ability. The species studied can be classified in increasing order of the germination ability and a decreasing seed weight as follows: *V dasycarpa*, *V. sativa*, *V. ervilia* and *V. narbonensis*. The negative correlation between the seed weight and the germination ability that was show in our study is a very important factor for the selection of performing species. Other biological and agronomical aspects such as vegetative production per species, the production period, and the effect of the depth seedbed and the adaptation of species to pedoclimatic conditions need to be investigated. All these parameters will allow making appropriate selection of the species and hence will contribute to the improvement of fodder production in Algeria.

REFERENCES

[1] Abdelguerfi A. Contribution à l'étude de la répartition des espèces localesde luzernes annuelles en fonction des facteurs du milieu (200 stations).Liaisons entre les caractères de ces 600 populations étudiées à Beni-Slimane et leur milieu d'origine, thèse ingénieur INA, 1976 ; 74p.

[2] Abdelmoneim ,A.M. Agronomic potential of three vetches (Vicia spp.) under rainfed conditions, Agronomy Sc. Crop Science, 170, 1992 ; 113-120

[3] Abdelmoneim, A. M. and Saxena M. C. Developing cultivated forage legumes for improved yield and quality to feed livestock in the dry areas. Proceedings of the Regional Symposium on Integrated Crop-Livestock Systems in the Dry Areas of West Asia and North Africa, ICARDA, Aleppo, Syria, 1997; 142 – 151.

[4] Abbas K., Abdelguerfi, A. "Perspectives d'avenir de la jachère pâturéedans les zones céréalières semi-arides", Fourrages, 184, 2005 ; 533-546

[5] Abbas K., Abdelguerfi-Laouar M., Madani T., M'hammedi BouzinaM., Abdelguerfi A. Place des légumineuses dans la valorisation de l'espace agricole et pastoral en régions nord d'Algérie", Diversité des fabacées fourragères et de leurs symbiotes applications biotechnologiques, agronomiques et environnementales, Workshop int., Alger 2006 ; 309-320

[6] Arar R. Etude des stades juvéniles de quatre espèces du genre Vicia. Mémoire de DES. INES de Biologie. Université de Sétif, , 2003 ; 22p

[7] Arab D. and Sai A. . Distribution de quelques espèces du genre" ViciaSpp" à Sétif, influence de quelques facteurs du milieu. Mémoire de fin d'étude d'ingénieur d'état en écologie végétale et environnement, Université de Sétif, 2006 ; 26p.

[8] Bahhady, F.A., Christiansen, S., Thoomson E.F.,HarrisH., Eeskridge K.M.,Papechristiansen A.. "Performance of Awassi lambs grazing commonvetch in on-farm and on-station trials", Proc. Symp. on Crop/Livestock Integration, Amman, Jordan ; 1997.

[9] Belbedjaoui A.B.Variabilité génétique, analyse agronomique et egrenage d'un germoplasme du genre vicia spp dans la région Humide d'Annaba .Mémoire d'ingéniorat en agronomie, 2005 ; 78 p.

[10] Côme D. Les obstacles à la germination. Edition Masson et Cie., Paris, 1970 ; 10 – 88.

[11] Hamadache A. Acte de l'atelier national sur la stratégie de développement des cultures fourragères en Algérie. Revue de l'ITGC, Alger, 2001 ; 9-18.

[12] Krausse S., Waltzien H., Mamlouk O., Cocks PS..Yield decline in continuouscereal systems. Pasture, Forage and Livestock, Program, Annual,Report 1987, ICARDA ;1988

[13] JONES M.J. The role of forage legumes in rotation with cereals inMediterranean Areas, Farming Systems of the Mediterranean Areas,Kluwer Academic Publishers, Dordrecht.Aleppo, Syria, 1990; 216-229.

[14] Kerman P.J . Les légumineuses fourragères tropicales. F.A.O., Rome, 1982.

[15] Labbé M. Ces étonnantes graines germées. Edition Labbé ; 2001.

[16] Lapeyronie A. La production fourragère méditerranéenne. Tome 1, Edition MaisonNeuveet Larousse, Paris ; 1982.

[17] Leewrik.M. The relevance of cereal-pasture legume rotation in theMiddle East and the North African Region", Proc 3rd Regional WheatWorkshop, 1976; 266-291.

[18] Mosjidis J. et Zhanz A.J.Seed germination root growth of several Vicia species at temperature. Seed Science and Technologie, 1995; 749 – 759.

[19] Moréne J.L. et Pujol R. Dictionnaire Raisonné de Biologie. Edition Frisson-Roche, Paris, 2003 ; 294 – 532.

[20] Puckridge D.W., French R.J. The annual legumes pasture in Cereal leyfarming systems of Southern Australia", Review Agriculture, Ecosystems and environment, 1983. 9, 229-267.

[21] Q iu J., Mosjidis J. A. and Williams J. CGrowth as affected by seed weight in vetch. Agronomy Journal, 1994. 86, 251–255.

[22] Rihawy S.L., Capper B.S., Osman A.E., Thomson E.F. Effect of crop maturity,weather conditions and cutting height on yield, harvesting losses and nutritive value of cereal. Legumes mixtures grown for hay production", Exp.Agric., 1987. 398- 459

[23] Samarah N.H. Effect of drying methods on germination and dormancy of common vetch (Vicia sativa L.) seed harvested at different maturity stages. Seed Science and Technology. 2005 .Volume 33, 3: 733-740.

[24] Aher F., Chakrou M. et Bounejate M.Actes des journées de création du Réseau Maghrébin pour l'avoine et la vesce. ., 1997 ; 1 - 20.

[25] Turk M.A.,.Effect of sowing rate and irrigation on dry biomass and grain yield of bitter vetch (Viciaervilia) and narbon vetch (Vicianarbonensis). Indian Journalof Agricultural Sciences 69. 1999; 438–443.

[26] Villax E. La culture des plantes fourragères dans la région méditerranéenneoccidentale : Maroc, Portugal, Algérie, Espagne, France", Cah. Rech. Agro., INRA., Rabat. 1963 ; 17-641 p.

[27] Wattiaux M.A. et Howard W.T. Aliments pour les vaches laitières, Nutrition et Alimentation. Département des Sciences Laitières, www. Google.com. 2006.