Results

The generation interval, ranging from 1.49 (OCS) to 1.83 (BLUP), did not differ significantly between the 20 different scenarios. The average accuracy was 0.51. The genetic gain increased from NoS to BLUP with slightly lower values for OCS than for BLUP. The difference between OCS and BLUP in genetic progress was not significant. Type of mating did not affect rate of inbreeding or genetic gain. The value of heritability of MQT did not affect the genetic gain, but the genetic gain tended to be higher with h^2 of 0.4 than 0.2. The rate of inbreeding was significantly lower ($P < 0.05$) in NoS and OCS than in BLUP. The rate of inbreeding in BLUP schemes was significantly affected by the population size ($P < 0.05$), with lower values in the population of 2002 animals than in the population of 860 animals. The first 4 years in the simulation corresponded to the time to build the structure and to have some information to evaluate the genetic progress. Whatever the population size, there is no genetic gain in NoS schemes. Genetic gain in BLUP schemes was slightly higher than in OCS schemes ($P < 0.05$). Inbreeding coefficients fluctuate in BLUP schemes with substantial rise in the last 5 years, especially in the smaller population. In NoS and OCS schemes, inbreeding coefficients remained constant along the years with higher values in OCS schemes than in NoS schemes. The simulations showed that in the smallest population (860 animals in the nucleus), inbreeding increased by 0.7% when mating was performed at random. In the system with 77 herds (2002 reproducers), inbreeding was the highest with the BLUP scenario (3.2%) whereas low values were obtained in OCS and NoS scenarios (0.85 and 0.42%, respectively). With OCS, a genetic progress almost as large as with truncation can be achieved (0.32–0.47 vs. 0.40–0.50 genetic sd) at a considerably lower rate of inbreeding (0.7–1.2 vs. 2.3–5.1%).

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A scheme for improvement of smallholder goat production in Indian villages

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The Indian Council of Agricultural Research has implemented the All India Coordinated Research Project (AICRP) on Goat Improvement which has been going on for more than ten years. Currently there are 12 field units for different breeds in different parts of the country and three organizational farm units. The objectives of the field units are to assess the production performance of goat breeds in village flocks and improve them through selection, to evaluate the economics of goat production and to disseminate pro-poor goat based technologies and evaluate their impact on goat production. A field unit for the Osmanabadi goat breed was started at the Nimbkar Agricultural Research Institute (NARI) in April 2009 under this project. It is aimed to use the information collected under this field unit to promote comprehensive goat development including genetic improvement in the areas covered by the field unit.

Under the Osmanabadi goat field unit, a survey of the socio-economic status and goat management practices of goat keepers of Bibi and Wadgaon villages, 20 km from Phaltan town, in the Satara District of Maharashtra State of India was carried out in September–October 2009 with a specially designed questionnaire. There were 469 households in total in Bibi and 138 in Wadgaon according to the 2001 census. Out of these, 55 households in Bibi and 37 in Wadgaon reared goats. All the 92 goat owners/keepers owning 337 adult does (and 194 kids) were interviewed in the two villages. Phenotypic characteristics and body weights of their goats were recorded after individual identification of all adult does with ear tags. NARI's extension workers visit all the goat owners periodically and record births, deaths and sales, body weight of kids and does, milk yield of does, expenditure incurred on goat rearing and income earned. A database using MS Access has been specially prepared to store and retrieve the data for analysis. The extension workers organize vaccination, deworming and spraying of villagers' goats against ecto-parasites. Training leaflets in the local Marathi language are being prepared to create awareness among goat keepers about vaccination and first-aid treatment.

Fifty-one percent of the 92 goat keepers owned only one adult doe each; another 29% had 2–3 does; 7% had 4–6; 7% had 7–10 does, 5% had 11–16 does and only two owners had more than 20 adult does each (one of these had 46 adult does). The majority of goat owners (80%) thus had less than 3 adult does each. However, they owned only 34% of the total number of goats. Forty-seven percent of the goats were owned by those having 10 or more does each. The existence of a large number of goat owners having only one or two does poses a challenge to implementing development strategies since most of these owners understandably do not appear to have the high level of interest and involvement in improving their goats as the larger goat owners. Thirty-eight percent of the goat owners from Bibi and 35% of those from Wadgaon also owned cows and buffaloes. Those that owned more than 10 does tended not to own any cows or buffaloes.

Seventy percent of the goat keepers did not give any supplementary feeding to their goats and relied almost entirely on available natural grazing and browsing from neem and acacia trees for the sustenance of their goats. They grazed goats on either their own land or on common lands. The 30% who provided some supplementary feeding, gave about 100 g homegrown grain (i.e. wheat, sorghum, pearl millet or maize) to kids and kidded does for 3–4 months after kidding. Only four goat owners purchased expensive high protein feed such as groundnut cake mainly for kids. The average expenditure on feeding per kidded doe and its kids was Rs.189.

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Sale of kids was the most important source of income from goat rearing. Sixty-six percent of the goats sold during the study period (101 out of 154) were 3 to 6 months old; 28% were 6 to 12 months old and only 6% were younger than 3 months. The average sale price was Rs.122 per kg live weight. The sale price obtained from sale of 3 to 6 month old goats was 8% higher than the average (i.e. Rs.131 per kg live weight).

The important constraints to village goat rearing were found to be the lack of selected breeding bucks, shortage of grazing, browsing and fodder in the summer, inadequacy of veterinary health care and uncontrolled breeding leading to early breeding of young does and consequent loss of the first kid crop of these young does.

The AICRP scheme has made available an opportunity to start performance recording and simple genetic improvement programmes among village goats of different Indian breeds. These need to be combined with goat management improvement including training of goat owners in basic veterinary health care, appropriate feeding management using local resources and breeding management to maximize productivity. Goat owners also need to be organized so that they can take advantage of subsidized bank loans to purchase goats. Such organizations can then be empowered to carry on performance recording, insurance, training, common property management, fodder resource enhancement programmes and other beneficial activities. NARI will collaborate with other NGO such as Paryay in the Osmanabad district in Maharashtra to establish a model goat improvement scheme.

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Impact of the type of experimental infection with *Haemonchus contortus* and post-weaning parasitism level on genetic evaluation of the resistance of Creole kids

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Introduction

Naturally infected tropical pastures allow genetic evaluation of Creole goat resistance to gastrointestinal strongyles (Mandonnet *et al*., 2006). The Creole goats of INRA-Gardel herd are now indexed on their resistance under mixed natural infection conditions. However infection levels and proportions between *Haemonchus contortus*, *Trichostrongylus colubriformis* and *Oesophagostomum columbianum* populations vary across seasons and pasture management. The aim of this study was to test the impact of the level of post-weaning natural infection at pasture and the type of experimental infection on a standardized evaluation design of genetic resistance in Creole kids. We compared the differences between four levels of natural infection at pasture and two experimental infection types (single, SI; and trickle, TI) with *H. contortus*. Our hypothesis that animals may respond differently was based on the fact that the mixed grazing system reduces the parasite burden at pasture (Mahieu *et al*., unpublished data) and TI better mimics natural infection.

Materials and Methods

Three trials were involved in this study with a total of 169 male kids chosen from 3 successive cohorts of the Creole flock of INRA-Gardel in 2009 and 2010. Kids were reared at pasture from 3 months (weaning) until 7 months of age into a mixed grazing system with Creole cattle. Kids were allocated in 4 grazing groups according to the stocking rate based on the metabolic live weight ($LW^{0.75}$): 25% (kids 150 kg $LW^{0.75}$ and cattle 450 kg $LW^{0.75}$), 50% (kids 300 kg $LW^{0.75}$ and cattle 300 kg $LW^{0.75}$), 75% (kids 450 kg $LW^{0.75}$ and cattle 150 kg $LW^{0.75}$) and 100% (kids 600 kg $LW^{0.75}$). The pedigree of each animal was available from the foundation generation of 1979 and each animal was genetically indexed for faecal egg counts (FEC) at 11 months of age. Four months before experimental infections, kids were drenched, housed, and fed a forage diet based on *Dichanthium* spp., mineral licks and tap water *ad libitum*. During this period, limited nematode infection occurred but without any clinical signs. At 10 months (one month before beginning the experiment), the kids were drenched and they received ad libitum parasite-free *Dichanthium* spp. hay. At 11 months they were allocated into 2 groups according to the infection type. At day 0 (D0), experimental infection was induced with a single dose of 10,000 *H. contortus* L_3 (SI, $n = 84$) or 1,000 L_3/day during ten days (TI, $n = 85$). Each infected group was constituted of one half resistant (R) and one half susceptible (S) genetic indexed kids. FEC, packed cell volume (PCV), blood eosinophilia (EOSI) were weekly recorded until D42 after infection. Kinetics of each variable was modelled using mixed procedure of SAS software release 3.1 (SAS institute Inc., 1999).

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