Cereals attract wild avian herbivores in wet grasslands – Implications for range management

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Cereals attract wild avian herbivores in wet grasslands – Implications for range management

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Abstract. The aim of this paper was to investigate the effectiveness of the broadcast seeding of common wheat (*Triticum aestivum*) in order to increase the available wintering food for geese species, along the eastern shoreline habitat of the Kerkini Lake, Greece. Seeding wheat increased the total plant cover and subsequently reduced the percentages of the bare soil and the mosses' cover at about 20%. Herbage biomass was also increased (about 30%) compared to the non-seeding sites. Herbage utilization rates by geese species were increased more than 40% in December, i.e. only two months after the implementation of the seeding process. In conclusion, seeding cereals is a promising management practice in order to increase the availability of food for the avian herbivores during the critical wintering period.

Keywords. Broadcast seeding – Geese – Grazing – Food availability.

Les céréales attirent les oiseaux sauvages herbivores dans les prairies humides – Implications pour la gestion des parcours

Résumé. *Le but de cet article était d'étudier l'efficacité du semis à la volée de blé tendre (*Triticum aestivum*) afin d'augmenter la nourriture d'hivernage disponible pour les espèces d'oies, le long de l'habitat sur la rive est du lac Kerkini, en Grèce. Le semis de blé a augmenté la couverture végétale totale et a ainsi réduit les pourcentages de sol nu et la couverture de mousse à environ 20%. La biomasse de l'herbage a également augmenté (environ 30%) par rapport aux sites non ensemencés. Le taux d'utilisation des herbages par les espèces d'oies a augmenté de plus de 40% en décembre, à savoir deux mois seulement après la mise en œuvre du processus d'ensemencement. En conclusion, l'ensemencement avec céréales est une pratique de gestion prometteuse en vue d'accroître la disponibilité de nourriture pour les oiseaux herbivores pendant la période d'hivernage critique.*

Mots-clés. *Semis à la volée – Oies – Broutage – Disponibilité alimentaire.*

I – Introduction

Among many factors capable of shaping the distribution of birds, the availability of winter food supplies is of vital importance (Folmer *et al*., 2010). It seems that this is also holding for the Asiatic population of the Lesser White-fronted Goose in China, where it heavily uses the heterogeneous recessional grasslands of the East Dongting Lake (Wang *et al*., 2013). It also plays a major role for bird species in order to withstand the harsh weather conditions during winter and also to be prepared for the trip back to their breeding areas (Owen and Black, 1990). Furthermore, food availability during winter may affect the following breeding success (Morrissette *et al*., 2010). Cereal crops may constitute a substantial part of geese diet (Vickery and Gill, 1999) and may attract wild herbivores outside of the protected (non hunting) area (Fox *et al*., 2005). Seeding cereals and generally highly palatable cool-season grasses may be an important benefit for the LWfG because both the availability of forage is expected to be increased and their movements to other areas outside the protected area of the Kerkini Lake National Park are also expected to be further minimized.

The aim of this study was to investigate the effectiveness of seeding cereals in enhancing winter food supplies for goose species in the wet grasslands zone near the shoreline of Kerkini Lake, northern Greece.

II – Materials and methods

The study area was the marshy grassland at the northern and eastern parts of the Kerkini Lake (no more than 300 – 400 m away from the shoreline). Kerkini Lake is a National Park included in the list of the wetlands of international importance for waterbirds (according to Ramsar convention) and is a Special Protection Area (SPA). Due to the lake's operation as an irrigation reservoir, this area is temporarily covered with water six to eight months annually (usually from mid winter to August). As a consequence, the study area is available for grazing by geese usually from August to December – January each year. This marshy freshwater habitat is dominated by *Echinochloa crus-galli*, *Paspalum paspalodes*, *Ranunculus* spp., species of the *Cyperaceae* family, etc. Several geese species, such as the Lesser White-fronted Goose (*Anser erythropus*), the Greater White-fronted Goose (*Anser albifrons*), the Greylag (*Anser anser*) and, occasionally, a few (2 or 3 individuals) escaped Aegyptian Goose (*Alopochen aegyptiacus*) use this habitat for feeding.

Winter wheat (*Triticum aestivum*) was seeded in the marshy habitat, i.e. the main feeding habitat for geese species in order to increase the available food for herbivores during the wintering months. In total, 12 plots at three size levels were seeded (0,5 ha, 0.05 ha and 0.005 ha – 4 plots per level), using the broadcasting method. In addition, 12 plots (3 x 3 m) within three fenced, control (protected from grazing) plots (20 x 20 m) were also seeded with the same method. Seeding was performed at a seeding rate of 250 kg / ha during October of 2014, without any prior preparation of the soil in order not to affect the native vegetation which also constitutes a food resource for geese (Karmiris *et al.*, 2014). During the next two months (November and December), the total plant cover (%) and the average plant height (cm) were estimated in 100 randomly selected plots (0.5 x 0.5 m) in each of the seeded and native sites. In addition, the above ground biomass and the utilization rates of seeded (wheat) and native species were also estimated by clipping the vegetation in 10 randomly selected plots (0.5 x 0.5 m) in each of the free grazing and control sites (Cook and Stubendieck, 1986). Field data were collected twice a month during November and December (at the first and second half of each month). Afterwards, the study area, as well as the wider area including the non-marshy habitat was flooded constituting an unsuitable feeding habitat for geese. This flooding in early winter can be considered as an exception as the whole area is usually flooded in late winter or in early spring (Pyrovetsi and Papastergiadou, 1992). Because no significant differences in any of the vegetation parameters were found among the three size levels of the seeded sites ($P > 0.05$ in all cases) the data were combined for further analysis.

Significant differences in total plant cover in seeded and native sites were evaluated with the Kruskal - Wallis one-way analysis of variance (Siegel and Castellan, 1988). Vegetation (native and seeded) height data, as well as above ground production data were subjected to one-way analysis of variance (ANOVA). Protection from grazing was treated as a fixed factor with two levels (no protection and protection from grazing). Levene's test was performed prior the analysis in order to check the homogeneity of variances (Petrie and Watson, 1999). Differences were considered significant at $P \leq 0.05$.

III – Results and discussion

Plant cover was estimated significantly higher ($\chi^2 = 130.402$, df: 1, $P < 0.001$) in the seeded sites in relation to the native sites (Table 1). As a consequence, cover of bare soil and mosses followed an inversed trend. Height of wheat plants was relatively low in November (3.5 cm); however, one month later their height was almost tripled (9.1 cm), but still significantly lower ($F = 23.563$, df: 1,198, $P < 0.001$) than the height of native vegetation (11.8 cm).

Above ground biomass of the species which potentially constitute food for the herbivores was also almost doubled and significantly higher ($F = 53.771$, df: 1,18, $P < 0.001$) in the seeded sites in comparison to the native sites (Table 1). Wheat above ground biomass was an available food

resource for the geese even from November (i.e. only one month after seeding) despite the relatively low height of the wheat plants (just 3.5 cm). This is more profound during early December (i.e. about 40 days after seeding) when geese were used the seeded sites for feeding. By the end of December, all the seeded areas were grazed by geese intensively and the utilization rates of the wheat in December (almost 60%) was even higher than the respective rates (about 44%) of the native vegetation.

Table 1. Vegetation parameters (plant cover, height and above ground biomass) in the seeded and native sites in the marshy habitat at Kerkini Lake in December 2014

Vegetation parameters*	Seeded sites	Native sites
Plant cover (%)	52.7[a]	26.1[b]
Height (cm)	9.1[a]	11.8[b]
Above ground biomass (g)	29.6[a]	14.1[b]

*Different letters within a row indicates significant differences at a = 0.05.

Cereal crops may constitute a substantial part of the diets of geese species (Vickery and Gill 1999) and may modify their usual movement pattern (Fox *et al*., 2005, Wang *et al*., 2013). In addition, LWfG have been recorded occasionally in previous years to feed on the non-marshy habitat and in cereal crops outside of the protected area of the Kerkini Lake National Park (Kazantzidis and Naziridis, 1999). Under this perspective, the unusual behavior of LWfG to visit other non-protected feeding areas may be justified by the unavailability of their food. Seeding cereals and generally highly palatable cool-season grasses may be an important benefit for the LWfG because both the availability of forage is expected to be increased and their movements to other areas outside the protected area of the Kerkini Lake National Park are also expected to be further minimized. Consequently, it is expected that such approach will increase the ecosystem's carrying capacity, i.e. to support a higher number of herbivores for a longer period each year. This may further reduce the accidental shooting of LWfG in Europe, which according to Jones *et al.* (2008) constitutes the main threat of the European population of LWfG. At Kerkini Lake, an adult bird was found shot outside the protected area of Kerkini Lake in 2007 (Tsougrakis *et al*., 2009).

The further and in depth investigation on the movement pattern between/ and within habitats of LWfG (selection of habitats and microhabitats) during the upcoming years should be high in research priority setting. This knowledge is required to assist in prioritizing multiple management actions for the conservation of the European LWfG population and their habitats. Creation of alternative feeding sites for geese, as it was investigated in this study, seems to be a promising, feasible and low cost range management practice which it has been tested successfully for many geese species (Owen and Black, 1990, Percival, 1993, Vickery and Gill, 1999). These sites should be located at the upper parts of the marshy habitat or even more at the boundaries with the non-marshy habitat (i.e. about 400-450 m away from the shoreline), where flooding occurs at a later time in relation to the parts of the marshy habitat near the shoreline. Under this aspect, seeding cereals (e.g. *Triticum aestivum*) in specific sites in the marshy habitat before the arrival of the LWfG (i.e. late September – early October) is a management practice which will enhance the availability of food during the winter.

IV – Conclusions

Seeding winter wheat in the main feeding habitat of goose species at Kerkini Lake increased the total plant cover and the above ground production and subsequently the availability of food for geese. Furthermore, seeding sites attracted geese within 40 days after seeding and herbage utilization of the seeded sites was higher than the sites covered by native vegetation. Seeding winter wheat in the marshy habitat at Kerkini Lake without preparation of the soil is a promising

and feasible solution in order to increase the availability of food and to create alternative wintering feeding areas for geese.

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