The influence of agriculture practices and soil properties on weed damage to crop performance in North-Central Namibia
～With particular attention to harmful weed: *Cynodon dactylon*～

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Keyword: agricultural practices, crop production, Cynodon dactylon , livelihood, pearl millet, soil properties

1. Background and Objectives

North-Central Namibia is in the semi-arid area and the annual rainfall is 400-500 mm. The farmers cultivate pearl millet by rain-fed agriculture (Uno, 2005). Crop production is very low because of low fertile soil and unstable precipitation. In addition, population growth causes expansion of the cultivated land (Mendelsohn, 2000), while it has been a problem that the harmful weed (*Cynodon dactylon*, *CD*) invades into cultivated land and causes the decrease of crop yield. Therefore, they need to utilize cultivated land effectively to conduct agriculture production in this region. The final goal of this study is to propose the agricultural practices for controlling *CD*. Three objectives of this study were 1) to reveal livelihood and agriculture's characteristic (agricultural practices and livestock) that the villagers have conducted, 2) to reveal the factors affecting the spatial distribution of *CD* based on the soil texture of each soil type which villagers have recognized, and 3) to evaluate the effect of agricultural practices on weed damage to crop performance.

2. Study Area and Methods

Study area was Onakasino village in Namibia. This study was conducted by interviewing Onakasino villagers (Total 3 weeks during 2014/12-2015/1 and 2015/10) and field experiment in a farmer's field from January to May 2015. In the field experiment, 4 treatment plots was set up (combining plowing, non-plowing, fertilization and non-fertilization) in two fields where *CD* grows and doesn't grow with three replications. Measured were precipitation, soil water content, soil texture, height, yield and biomass of pearl millet, biomass of *CD*, hydraulic conductivity and water retention. Soil samples were collected from 4 soil types which villagers have recognized as follows: 14 points in "Loamy soil", 11 points in "Sandy soil", 1 point in "Clayey soil" and 7 points in "Intermediate between Loamy and Sandy soil (Loamy/Sandy soil)".

3. Results and Discussion

The interview survey revealed that cash and food exchanged with the outside of O village and the villagers conducted agriculture in their diverse livelihood. O villagers use tractors or employ labors for plowing to conduct laborsaving agriculture, while they invest less money in fertilizer. This indicates that they invest their money only when farm work is effective. Regarding the relation between *CD* and soil type, *CD* is distributed in 90% of the field with "Loamy soil" and only 4% of the field with "Sandy soil". It was found that "Loamy soil" had 4.1% of clay content and low hydraulic conductivity compared to "Sandy soil". The fact suggested that better soil water condition in "Loamy soil" was favorable for *CD*. The precipitation was only 165 mm, so pearl millet growth was mostly bad. Field experiment showed millet yield was 7.35 kg/ha in the cultivated land with *CD*, which was one-tenth of that in the cultivated land 68.2 kg/ha without *CD*. Monitoring of soil moisture data suggested that the competition between *CD* and pearl millet for water occurred in surface soil (0-20 cm) decreased pearl millet yield. Although plowing and fertilizer increased biomass of pearl millet, this treatments did not mitigate the *CD* damage to pearl millet growth. Therefore, it can be stated that weed damage to crop growth is difficult to alleviate by agriculture practices. In conclusion, considering that O villagers conduct low-cost and laborsaving agriculture, preventing *CD*'s expansion by making buffer zone would be useful in "Loamy soil" and "Clayey soil" where *CD* occupies largely, while exterminating *CD* by deep plowing and herbicide would be useful in "Loamy soil" and "Loamy/Sandy soil" that *CD* rarely occupies.

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