

Impact of Nitrogen Tax on Nitrogen Use in Lithuania

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Introduction

The use of nitrogen (N) fertilizers causes negative external effects, but is inevitable due to the increasing food demand, limited fertile lands. Generally, fertilizer use in Lithuania has to comply with EU (Nitrate Directive) and national regulations and requires fertilization plans on each farm. In practice, Lithuanian farmers are not forced to fully control the amount of mineral N added to the soil. Recommended N norms are used according expected yield. In Lithuania data related with N use has been started publishing few years ago.

N tax is one of the financial instruments for reducing negative externalities and environmental pollution. Mineral fertilizer use can potentially be controlled by imposing an N tax.

A tax on N can be regarded as an environmental tax. Collected incomes from polluters could be allocated to compensate the externalities or distributed back to the agricultural sector. In presence of a tax, it can be expected that farmers reduce their N fertilizer use, but information about the response of farmers is scant.

N is applied as mineral and organic fertilizer. The higher damage for nature comes from mineral than organic fertilizers use, therefore attention should be focused on that first. It is difficult to control how much organic fertilizer is used on farms. The use of organic fertilizer is mostly originated by the animal husbandry in the farms. By EU regulation this is restricted to the amount of manure containing 170 kg N/ha. Therefore, it can be expected that farmers rather respond to economic incentives on mineral fertilizer application than on organic fertilizer application. Since farmers as in a business seek generation of profit, existing price structures might create an incentive to use N at higher than the recommended rates. In some situations, plant demand for N is not balanced by N rates and is not adjusted to the N amount already available in soil.

This paper presents an empirical approach to estimate price elasticity of demand for mineral fertilizers through farmers' reaction on nitrogen price changes. Price elasticity of demand for mineral fertilizers allows to evaluate the N tax impact on N use and make recommendations for further evaluations. This elasticity coefficient has been shown to be rather inelastic in many studies, also indicating a huge range of possible elasticities. Thus, economic incentives might have limited effects on purchase of mineral fertilizers, depending on the elasticity of demand. The impact of N tax on N use is analyzed through price elasticity of demand in this study.

Methodology

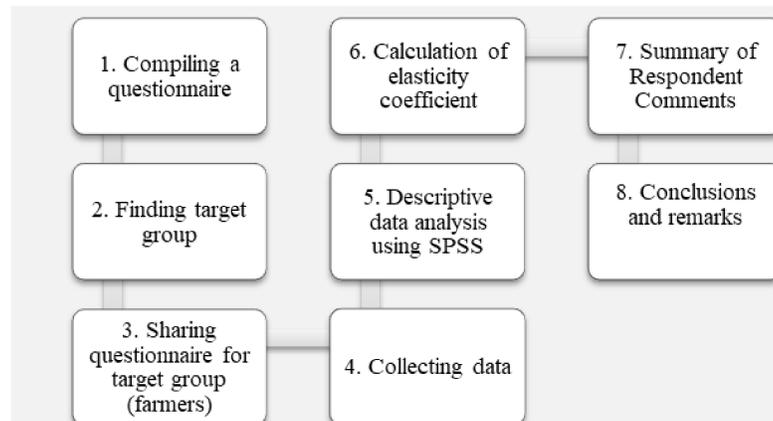


Fig. 1: Study flowchart

Data were processed in SPSS and Microsoft Excel programs. The price elasticity of demand was calculated for three levels of taxes on fertilizer prices (25, 50 and 100 percent). For tax scenario respondents were asked to what percentage they would reduce the purchase of N fertilizer. N surplus was calculated according determined nitrogen values. Furthermore, the farmers were given opportunity for comments. The investigation was conducted at indicated stages (Fig. 1).

In order to find out farmers' possible response to changed prices for N fertilizer a questionnaire was set up. The questionnaire "Farmers' Response to Rise in Mineral Fertilizer Price" consisted of 8 questions, which consisted of the following guidelines: type of farm, farm size, type of fertilizer using, use of N norms on yield, reduced amount of N in reaction to increased price, comments.

Results

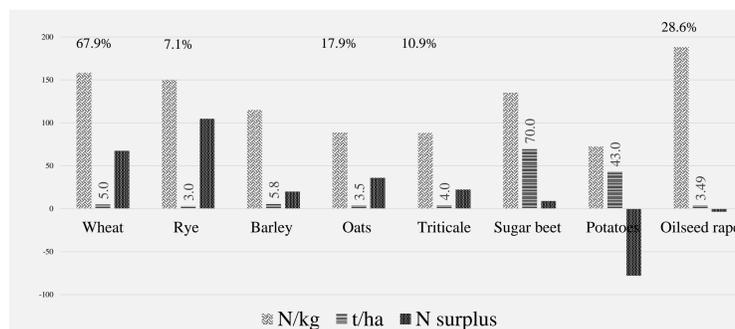


Fig. 2: Used nitrogen, yield and nitrogen surplus of 2019 yield

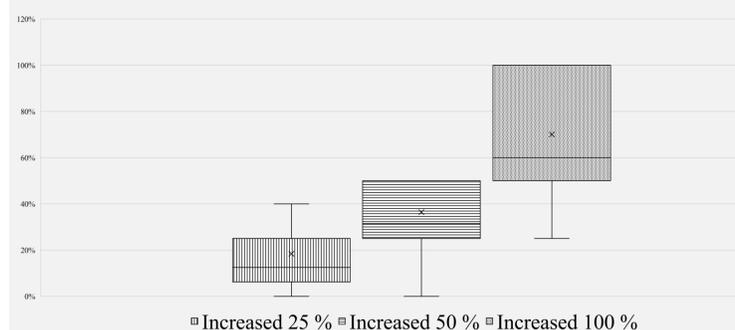


Fig. 3: Box plot of decreased purchase of the N increased price scenarios

Farmers claim that fertilizer prices are already high. Some of them argue they would refuse agricultural activities if the N price increases very high. One important aspect related to fertilizer price is farmers' income which is related with such an input as fertilizers ("N fertilizers increased yield by 70%). Is confronted with the opinion that farmers would change growing crops, e. g. would grow buckwheat which according to them do not need mineral N fertilizer or refuse farming ("With the sharp rise in fertilizer prices, I would not continue farming"). Farmers would refuse mineral N fertilizer and start using organic fertilizer and it might have influence organic fertilizer demand. That would reach one of the main mineral N tax purpose. Some of respondents have started decreasing mineral N using ("We have already reduced the use of N. In autumn we sow winter rape, when it sprouts we plow it"). There were farmers who ask tax exemption for mineral fertilizer.

Price change (%)	Price elasticity coefficient of demand (on average)
25	0,69
50	0,66
100	0,7

Tab. 1: Price elasticity coefficient of demand

Main conclusions

This study has shown that an N tax in Lithuania would result in reduced fertilizer use among Lithuanian farmers. The response to a tax would be limited to an elasticity of on average 0.7, confirming the inelasticity of demand, found in other studies. The range of responses indicate that individual farmers probably would react differently, which should be taken into account in further considerations. N tax affects the economics of farming, even though the main purpose of an N tax is not to collect money to the state budget but to reduce negative externalities associated with N use. N tax is a fiscal instrument for reducing environmental pollution and collected money should be brought back to the agriculture sector as returns for farmers or mitigate the effects of environmental pollution. Farmers reaction to an r N tax is negative, it shows negative reaction to the increased fertilizers price. N tax can reduce N use though economic, social and environmental issues which should be taken into consideration.