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Review on the effects of NPS fertilizer rates on growth, yield components and yield of cabbage (*Brassica oleracea* var. *capitata* L.)

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Abstract

Cabbage (*Brassica oleracea* var. L.) is also known as cool vegetable crops. It is one of the most famous and broadly growth vegetable crops in the world.

It includes a range of crucial vitamins and minerals as nicely as small amount of protein and proper caloric value. Cabbage is an incredible supply of mineral such as calcium, iron, sodium, Potassium and phosphorus. In our United States of America has a range of vegetable plants grown in exclusive agro-ecological zones with the aid of small farmers, mostly as a supply of profits and food. Cabbage can be grown at any time of the year however better pleasant and increased yields can be acquired at some stage in warmer months of the year. Cabbage has been domesticated and used for human consumption due to the fact that the earliest antiquity. It is solely head cabbage that modifications in leaf shape becoming wider because of the shorter petiole size with increasing leaf function and hence cabbage acquired the developmental exchange in leaves. Nitrogen is a constituent of all dwelling matters a synthesis and switch of energy. NPS fee has a massive impact on cabbage quality.

Keywords: Cabbage, NPS fertilizer, growth and yield

Introduction

Background and Justification

Cabbage (*Brassica oleracea* var. L.) belongs to the household Brassicaceae and it is biennial crop with a very short stem helping a mass of overlapping leaves to form a compact head. It originated from wild non-headed kind colewort from Western Europe and northern shore of Mediterranean. It has been domesticated and used for human consumption considering the fact that the earliest antiquity. It is cool season crop that is famous with gardeners and industrial producers (Muzimal *et al.*, 2011) [29].

Cabbage is recognised for its nutritional importance and it is rich in mineral and vitamins like A, B1, B2 and C. It is additionally understand an appetizer, it aides digestion thereby help stopping constipation. It additionally protects towards cancers (Muzimal *et al.*, 2011) [29]. Cabbage can grow without problems under vast range of environmental condition in both temperate and tropical, but cool moist local weather is most suitable (Muzimal *et al.*, 2011) [29].

Cabbage is grown for its head in greater than ninety international locations all through the world (Meena *et al.*, 2010) [23]. The major cabbage growing international locations of the world are china, India, South Korea, Germany, Japan and South Africa (Muzimal *et al.*, 2011) [29]. The region planted with headed cabbage international in 2009 was estimated at about 3.2 million hectare in 124 international locations manufacturing some seventy one million tones. In the equal year, vicinity planted by way of cabbage was once about 2.5 million hectare in Asia, 0.5 million hectare in Europe, 80,000 hectare in America and 120,000 hectare in Africa (Nina, 2011). In Africa a complete of two million lots had been produced in 2008 and it has shown an expand with the aid of 20% over the 10-year period between 1998 and 2008.

Area, production and yield of head cabbage in Ethiopia 2007/2008 have been 1989 hectares, 11,765 tons and 5.9 t/ha respectively. In 2008/2009 it grew to 3399 hectares, 24, 133, 4 tons and 7 t/ha respectively. Within these two years the location has elevated via 70% whereas the manufacturing has expanded with the aid of 105%. In Oromia Regional country the area blanketed by way of head in 12 months 2008/2009 used to be 2188.9 hectares while the production was once 15,601.9 ton and the yield is 7 t/ha (CSA, 2017).

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In accepted crop manufacturing can be multiplied both by way of enhancing inherent genetic conceivable of the crop or through utility of better agronomic management such as fertilizer rate which contribute to enormous amount of crop (Frezer, 2007) [16]. The possibility of securing high yield depends a lot upon a appropriate consideration of ultimate NPS price per unit location and the pattern in which the given volume of seeds or plant population is organized in the field of planting (Bnchalem Adisu *et al.*, 2010) [9]. This is due to the fact that the extent of solar radiation, which penetrates a crop canopy greatly, relies upon on price and man or woman plant morphology (Bnchalem Adisu *et al.*, 2010) [9].

Likewise the plant density, low soil fertility additionally viewed as serious issues among countless manufacturing limiting factors in the study area. NPS in one of the vital plant vitamins in cabbage yield and it is big to note that nitrogen fertilizer (response is immediately associated to the soil type, emphasizing that soil various in fertility popularity react differentially to the utilized (Frezer 2007) [16]. NPS fertilizer which is fairly extra vital for cabbage first-class development should be the excellent alternative. And investigating the highest quality fee of NPS fertilizer for cabbage below our country is vital condition. Generally, may additionally cause a magnificent loss on growth, productivity and dietary first-rate of cabbage. Therefore appropriate use of NPS fertilizer for the plant can resolve the impacts growth of the cabbage. However NPS degree have to be regulated to attain excessive yield from cabbage. Thus it's require making use of excellent of fertilizer for the more desirable cabbage productivity and sustainable yield many experiment shows that NPS utility expand the complete yield of cabbage (Sompong *et al.*, 2010) [43].

Nitrogen is an essential primary nutrient thing for plant. For vegetable crop, it is more beneficial due to the fact it is the most important component of amino acids as nicely as proteins. Adequate grant of nitrogen is integral for normal increase and yield (Mozumder *et al.*, 2003) [27]. Without N it is now not feasible to synthesize the critical proteins, enzymes, DNA and RNA required in virtually all plant cells for their initial development, sustained growth and functioning to support other tissues of the plant. So, deficiencies in reduced N always outcomes in much less biochemical machinery to catalyze plant metabolism and to generate new cells Mozumder *et al.*, (2003) [27] confirmed that extend of nitrogen up to 40 kg N ha⁻¹ elevated seed yield of cabbage.

Phosphorus is one of the three macronutrients that flowers have to gain from the soil. It is a most important aspect of compounds whose functions relate to growth, root development, flowering and ripening (Sompong *et al.*, 2010) [43]. Among the soil nutrient elements, phosphorus is the second most fundamental nutrient after nitrogen.

Many studies have proven that application of phosphorous fertilizers usually has notable have an effect on on crop yields due to the fact its deficiency limits the response of flora to other vitamins (Akinrinde and Adigun, 2005) [4]. Phosphorus utility (69 kg P₂O₅ ha⁻¹) to cabbage has accelerated plant height (Ayub *et al.*, 2010) [8]. Likewise, Khan *et al.*, (2002) [22] observed the most complete biomass and yield (1771 kg ha⁻¹) of cabbage was once got with phosphorus application at one hundred kg P₂O₅ ha⁻¹.

Sulfur performs a tremendous role in protein metabolism. It is required for the synthesis of proteins, nutritional vitamins and chlorophyll and additionally S containing amino acids such as cysteine and methionine which are fundamental components f proteins (Tisdale *et al.*, 2009) [47]. Sulphur is additionally an essential nutrient for plant growth and its uptake by way of flowers money owed 9 to 15% of nitrogen uptake (Inal *et al.*, 2003) [21]. Deficiency of S has lengthy been diagnosed as limiting nutrient for crop production (Yasmin *et al.*, 2007) [49]. Consequently, poor use efficiency of N with the aid of the plant is triggered via inadequate S availability to convert N into biomass production, which in turn might also extend N losses from cultivated soils (Ceccotti, 2008) [11].

Objective

To evaluate the effect of distinct charges of NPS fertilizer on boom and yield of cabbage

Literature Review

Description and Origin of Cabbage

Cabbage is originated from wild non-headed type colewort (*Crambeordifolias*) from Western Europe and northern shore of Mediterranean. It is originated from Western Europe and Northern Shore of Mediterranean place the place it has been grown for more than 3000 years. The genus *Brassica* includes about 100 species majority of which are native to Mediterranean region. It has chromosome quantity $2n=2x=18$ (Abraham, 2009) [1].

Cabbage (*Brassica oleracea* var *capitata* L.) is also recognized as Cool vegetable crops. It belongs to household Brassicaceae (or Crucifer) and generally referred as Brassicas. It is vital companies of crop worldwide. It is dicotyledonous biennial crop, but it is grown as annual.

Cabbage structure numerous distinctive head shapes: pointed, conical or oblong, spherical or drummed shaped. Cabbage commonly categorised as headed which is round, oval or flat. Chinese head cabbage is oval and flat, moreover it is loosely fashioned and light in weight. Head formation in cabbage is quantitative trait controlled additively with low dominance effect. It is solely head cabbage that modifications in leaf form becoming wider due to the fact of the shorter petiole length with increasing leaf function and consequently cabbage acquired the developmental change in leaves (Abraham *et al.*, 2009) [1].

Importance of the Cabbage Crop

Cabbage is grown for its leaves and frequently used as vegetable. Cabbage is an awesome supply of mineral such as calcium, iron, sodium, Potassium and phosphorus. It has big quantity of beta carotene, ascorbic acid and others. It has energy (27 %), fat (0.1%) and carbohydrate (4.6%0. It is good supply of protein (1.3%) which consists of all critical amino acids; in particular sulfur containing amino acids (Abraham *et al.*, 2009) [1]. The only section of the cabbage plant that is generally eaten by using human being is the leafy head; extra precisely, the spherical cluster of immature leaves, excluding the in part unfold outer leaves. Cabbage is used us row in salad such as coleslaw, as a cooked vegetable, or reserved in pickle or sauerkraut. Flavor in cabbage is due to the glycosides singing (Abrham *et al.*, 2009) [1].

A100g fit to be eaten element of cabbage includes 1.8mg protein, 0.1mg fat, 4.6mg carbohydrate, 0.6g mineral, 29

calcium.0.8mg iron and 14.1mg sodium (Banchalem *et al.*, 2010) ^[9]. Cabbage can be grown at any time of the year however higher high-quality and higher yields can be obtained at some stage in warmer months of the year.

Cabbage Production in Ethiopia

Ethiopia has a variety of vegetable vegetation grown in different agro-ecological zones by way of small farmers, in general as a supply of earnings and food. Commercial producers are additionally involved in the production, processing and advertising of vegetable. These crops are produced below rain fed and irrigation conditions. It is produced both in cereals based totally cropping device and in monoculture. Largely cabbage is produced by way of irrigation as an alternative than rain fed (Banchalem *et al.*, 2010) ^[9]. At existing exceptional crops are produced in many domestic gardeners and also commercially in distinctive components of the country. But most of the manufacturing is with the aid of small holder. Cabbage manufacturing in Ethiopia is scattered in the high lands however the large manufacturing is found at the central excessive lands of the usa Input and Supply Enterprise) are in the importation of seed and this has influenced the national market (Abrham *et al.*, 2009) ^[11].

The Role of NPS Fertilizer on Growth and Yield Cabbage

The doubling of Agricultural meals production global over the past four many years has been related with a seven fold make bigger in use of NPS fertilizer. As the final result of, both the recent and future identification of the use of NPS fertilizer in agriculture already has and will continue to have fundamental determinate influence on agriculture (Herel, *et al.*, 2007) ^[20]. Plant takes up NPS in the shape of nitrate or ammonium for natural matter, in organic rely and fixation of free NPS by using microorganisms. NPS play essential function in protein formation as factor of chlorophyll. Chlorophyll is required for light electricity absorption method of photosynthesis. Therefore, adequate NPS supply enhances the quantity of chlorophyll as result of amplify photosynthesis (More, 2006) ^[26]. The deficiency of NPS reduces statistics of chlorophyll, and nechrotic or symptom as end result flowers lose their inexperienced shade main to reduction of the fee of photosynthesis. Therefore, nitrogen is the motor of plant growth and being the necessary constituent of protein is concerned in all principal methods of the plant development and the yield formation. It stimulates cabbage satisfactory and encourages the improvement of giant stems and leaves. NPS tends to produce succulence, a first-class of excellent necessary in many greens (More, 2006) ^[26].

An ample furnish of NPS is related with lively increase and a deep green colour .cabbage great Since NPS favors g, it may extend maturity of fruits and seeds. Excessive quantities of NPS can underneath some circumstance prolong the developing length and delay maturity (More, 2006) ^[26]. This is most probable to happen when ample materials of different plant vitamins are no longer present. All plant life require ample of macro vitamins for healthful boom and NPS is a nutrient that is commonly in constrained supply. NPS deficiency in plants can happen when organic be counted with excessive carbon content, such as noticed dust is introduced to soil. Soil organisms use any NPS to damage down carbon source, making NPS

unavailable to plants. This is regarded as ‘‘robbing’’ the soil of NPS. All veggies apart from nitrogen fixing legumes are inclined to this disorder. NPS deficiency can be avoided in the brief term by way of the use of grass mowing mulch, or foliar feeding with manure, and in lengthy time period through constructing up degrees of organic be counted in the soil sowing green manure vegetation such as grazingrye to cover soil over winter will help to prevent nitrogen leaching, whilst leguminous inexperienced manures such as iciness tares will fix additional from the ecosystem (Sanderson *et al.*, 2008) ^[37].

NPS price had enormous impact on yield of cabbage and on fine of cabbage. It is performs an important function in the fitness and increase of all plants, and it is accountable for the inexperienced leaves and high-quality you see growing on them. NPS help flowers photosynthesize, which is a process that entails the use of strength from the sun to wreck down water and carbon dioxide so that sugars are formed. Cabbage requires nitrogen rich fertilizer. NPS is essential for the satisfactory of cabbages to begin. Cabbage is a heavy feeder due to the fact of the intensity of its leaf development, so it’s essential to add a 2nd supporting of NPS prosperous fertilizer 6-8 weeks after transplanting, articularly if a lot of rain has fallen (Adina 2009) ^[2].

Cabbage Response to NPS Fertilization

NPS over use in contemporary agriculture is of fundamental importance with appreciate to both environmental worries and the great of plant products. Cabbage as different cruciferous veggies has high nutritional cost and includes specific sulfur compounds glucosinolates that extend its antioxidant activity.

According to (Adina, 2009) ^[2] 10 fertilizer combinations were used to inspect the authentic impact of nitrogen on the yield of cabbage the therapy mixture of 240 kg N ha⁻¹ + 210 okay ha⁻¹ confirmed the fine end result (average 42.14 ha⁻¹) over the three years. As Malic and (Abraham *et al.*, 2009) ^[1] reported, cabbage yield amplify with increasing charge of Nitrogen application (5.8 ha⁻¹ and 33.15 ha⁻¹ with 0 and one hundred twenty kg ha⁻¹, respectively). Maximum net income and cost benefit ratio were got at one hundred twenty kg ha⁻¹. Similarly, Pant *et al.*, (2006) mentioned that cabbage yield extended to 49.83 + ha⁻¹ with increasing rates of nitrogen up to 180 kg ha⁻¹. Khadir *et al.*, (2002) studied the effect of nitrogen on the boom and yield of cabbage and said that the most important head weight and yield have been greater at the most charge of nitrogen (376 kg N ha⁻¹).

Sanderson *et al.*, (2008) ^[37] mentioned that plant increase and productiveness were accelerated with increasing degrees of nitrogen utility and was once the easiest yield (77.1 ha⁻¹) with 375 kg N ha⁻¹ applied. Parmar *et al.* (2009) document showed that higher tiers at nitrogen have often been found to induce finest yields in Brassica vegetables. (Sanderson *et al.*, 2008) ^[37] additionally suggested growing uniformity with increasing quantity of nitrogen applied. In cabbage manufacturing uniformity of heads is important. Increase in relative care length used to be found when NPS software price increased, whereas dry depend content material of the heads decreased. High levels of nitrogen have been determined to result in foremost yield in Brassica vegetables. Paramar *et al.*, (2009) suggested that increased yield of cabbage head to about four kg/m² fresh mass more than vegetation grow barring NPS fertilizer.

He additionally recorded higher yield in cabbage with extended NPS rate. According to these authors, the utility of 200 kg /ha nitrogen on loam soil produced considerably greater yield than 150 kg / ha nitrogen, however at par with 250 kg/ha NPS. This used to be attributed due to the fact that higher nitrogen levels want the boom of plants with larger leaf vicinity and it was more useful to make use of growth of plant life in head formation Asaduzzaman *et al.*, (2008) ^[7]. Observed considerably greater cabbage yield at 150 kg/ha than yield at 0.50 and a hundred kg/ha nitrogen yet par with yield at 200 kg/ha nitrogen on clay soil. Increase yield was once attributed to enlarge in head mass. Suhartatik (2008) ^[4] stated growing uniformity with increasing amount of nitrogen applied. In cabbage manufacturing uniformity in head is important. Increase in relative core size was found when nitrogen application charge increases, whereas dry count content of the head decreased. This was associated with softer head tissue at greater nitrogen availability, these by using having physical resistance to stalk elongation. He additionally discovered decrease in percent dry mass of the heads, accelerated range of burst heads and multiplied number of tip burn on the head with amplify NPS rate from a hundred and fifty kg/ha to 250kg/ha. It has consequently concluded that greater NPS fertilizer of 200 kg/ha diminished the fine of cabbage heads on loam soil. Head with and height make bigger with NPS fertilizer application. It has been standard that utility of NPS fertilizer enlarge yield, plant uniformity, and quality. An test performed via Sardana and Verma (2010) ^[52] in Bangladesh to examine three stages of NPS fertilizer charge that applied in split (60 kg/ha, one hundred twenty kg/ha and one hundred eighty kg/ha) on clay loam soil ought to the maximum yield of cabbage (65.11 + /ha) had been found from the plot receiving fertilizer fee of 180 kg/ha NPS and 60 kg/ha K2O5.

Effect of Nitrogen Fertilizer on Growth and Yield of Cabbage

Plant top is the important thing of straw yield and can also have an effect on the grain yield. It is a characteristic of both the genetic makeup of the plant and the environmental stipulations which the plant is subjected in the course of the growth. An test carried out by means of Sardana and Verma (2010) ^[52] mentioned that the application of nitrogen, phosphorus and potassium fertilizers resulted in huge will increase in plant height of cabbage. Also said that nitrogen, phosphorus, and potassium fertilizers appreciably accelerated the plant height of cabbage. Sardana and Verma (2010) ^[38] additionally got that the utility of nitrogen, phosphorus, and potassium fertilizers resulted in big amplify in leaf location index (LAI) of cabbage. Suhartatik (2008) ^[44] also said that residue of lime with NPK fertilizers appreciably increased the leaf place index (LAI) of cabbage. Similarly, Quah and Jafar (2003) stated that 1000-seed weight of cabbage elevated considerably with the software of nitrogen at 50 kg ha-1. Agbenin *et al.*, (2005) ^[3] also located that utilized N considerably expanded the dry remember of cabbage over the control. Basu, *et al.*, (2004) ^[10] found that, making use of 9 20, 30 or 40 kg N ha-1 proved that the shoot dry weight of *Vigna radiata* cv. B1 was multiplied with the purposes up to forty kg N ha-1. Leelavathi *et al.* (1991) ^[22] also stated that specific degree of nitrogen confirmed good sized

difference in dry count number of cabbage yield to 60 kg N ha-1 Asaduzzaman *et al.*, (2008) ^[7] said that utility of 30 kg nitrogen per hectare as basal and one irrigation at flower initiation stage (35 days after sowing) extensively expanded dry matter accumulation.

Effect of Phosphorus Fertilizer on Growth and Yield of cabbage

Phosphorus (P) has lengthily been known to be an crucial factor in the nutrition of plants. It plays key position in cell energy transfer, respiration, and photosynthesis and additionally phosphorus promotes the development of the root systems, seed formation, and hurries up ripening. In order to stimulate early growth and development, care be taken to supply the crop with a sufficient amount of easily handy P (Tisdale *et al.*, 2009) ^[47]. Phosphorous has a decrease mobility than any other nutrients and it does not stay in a free country for long in which it is slowly handy to flowers Parnes, (2005) ^[33]. Application of phosphorus as received sizeable impact on cabbage yield and agronomic parameters. Murat *et al.*, (2009) ^[28] said that phosphorus application (85 kg ha-1) to cabbage had huge impact on plant height, variety of branches, roots and shoot dry weights, Seed yield, and biomass yield, phosphorus content of the seeds. Gopala Rao *et al.*, (2012) ^[17] additionally reported that quantity of branches per plant accelerated significantly in phosphorus application up to 50 kg ha-1 alongside with 20 kg N ha-1. Ali *et al.* (2008) ^[5] additionally bought easiest seed yield (1036 kg ha-1) with phosphorus utility of 85 kgP2O5 ha-1 but, was statistically similar to sixty five kg P2O5 ha-1. Sharar *et al.* (2010) ^[40] concluded that 10 phosphorus purposes at one hundred kg P2O5 ha-1 produced the maximum yield (1158 kg ha-1) and its elements of cultivars. Tariq *et al.* (2001) pronounced that grain yield and its components of cabbage had been extended significantly by software of phosphorus at 70 kg P2O5 ha-1 (1733 kg ha-1).

Effect of Sulfur Fertilizer on Growth and Yield of cabbage

Sulfur (S) is one of the indispensable vitamins for plant growth and it accumulates 0.2 to 0.5% in plant tissue on dry be counted basis. It is required in similar quantity as that of phosphorus (Ali *et al.*, 2008) ^[5]. It is a constructing block of protein and a key ingredient in the formation of chlorophyll (Duke and Reisenau, 2008) ^[14]. Without adequate S, plants cannot reach their full doable in terms of yield or protein content material (Zhao *et al.*, 2005) ^[51]. Sulphur not solely accelerated grain yield but also expanded the quality of crops. Sulfur plays a brilliant position in protein metabolism. It is required for the synthesis of protein nutritional vitamins and chlorophyll and additionally S containing amino acid such as cysteine and methionine which are essential factors of proteins (Tisdale *et al.*, 2009) ^[27]. It is required for the synthesis of S containing amino acids such as cysteine and methionine. Their deficiency results in stunted growth, decreased plant height and delayed maturity. Application of S fertilizer is a feasible approach to suppress the uptake of undesired poisonous elements (Na and Cl) because of the adversarial relationship, therefore its software is beneficial now not only for increasing crop production and first-rate of the produce however also improves soil stipulations for healthful crop increase (Zhang *et al.*, 2007) ^[50]. Sulfur

improves K/Na selectivity and increases the capability of calcium ion to limit the injurious consequences of sodium ions in plants (Wilson *et al.*, 2000) [48]. Hegde and Babu (2004) [19]; showed that the utility of sulphur along with N, P and K to cabbage showed higher response than to cereals. Mitra *et al.*, (2006) [25] mentioned that inexperienced gram yield accelerated with growing levels of P and S fertilizers. Phosphorus at 60 kg P₂O₅ and S at forty kg ha⁻¹ gave the perfect cabbage growth and yield (1655 kg ha⁻¹), and net return on cabbage crop.

Effect of NPS Fertilizer on Growth and Yield of Cabbage

Mitra *et al.*, (2006) [25] stated that utility of 60 and 40 kg P₂O₅ ha⁻¹ being at par with every different produced considerably higher grain yield of cabbage over 20 kg P₂O₅ ha⁻¹ and control. However, the large make bigger in yield used to be acquired only up to one hundred p.c encouraged dose of fertilizer (20 kg N+ forty P₂O₅ ha⁻¹).

He additionally said great increase in whole dry rely accumulation/plant with expand in application stage up to 60 kg P₂O₅ ha⁻¹. The extent of extend in total dry depend with 60 kg P₂O₅ ha⁻¹ used to be 209, 70 and 17 percentage over control, 20 and forty kg P₂O₅ ha⁻¹, respectively. Singh *et al.*, (2011) also suggested really helpful impact of phosphorus application on the cabbage growth and yield of cabbage.

The interaction between potassium and sulphur, irrigation and potassium and irrigation and sulphur had been discovered to be significant. The perfect yield (1370 kg ha⁻¹) was bought when the crop was once handled with 30 kg K₂O ha⁻¹ and 30 kg S ha⁻¹. Singh *et al.*, (2011) said that leaf area/plant, precise leaf weight, whole dry mass/plant, flower number/plant, reproductive efficiency, wide variety of head/plant, yield have been significantly elevated with both foliar application of Nitrogen and Nitrogen along with micronutrient treated plant life over control.

Summary and Conclusion

Cabbage is one of the most feeder of plant nutrient includes NPS and exceptionally response NPS. It is one of the most popular and broadly growth vegetable crops in the world. It is respond properly to NPS fertilizer and adequate fertilizer is specially essential in the cabbage developing area. NPS promotes the growth and it is one of the most essential nutrient affecting the growth, improvement and exceptional of the plants. The boom and yield development the stage must be viewed when NPS utilized to healthy the nutrient plant demand. The study was carried out to check out satisfactory dosage of NPS for vegetative increase and yield and to recommended level of nitrogen rate. Cabbage can be grown at any time of the 12 months however higher pleasant and increased yields can be acquired during hotter months of the year.

NPS rate has a big impact on best and extent of cabbage. Similarly leaf width and cabbage head had giant distinction between different charges of NPS. Cabbage is an great source of mineral such as calcium, iron, sodium, Potassium and phosphorus. NPS helps flowers photosynthesize, which is a method that entails using power from the sun to spoil down water and carbon dioxide so that sugars are formed. NPS fee had good sized effect on yield and growth of cabbage. As preminent as NPS is to plant physiology,

many other nutrients in fertilizers are indispensable as well. Excess NPS in fertilizer can be just as troublesome as not enough.

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